10-3930-222-35

TM 10-3930-222-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL

TRUCK, LIFT, FORK, GASOLINE, PNEUMATIC-TIRED WHEELS 15,000-POUND CAPACITY (HYSTER MODEL H150C, ARMY MODEL MHE 178) FEDERAL STOCK NUMBER 3930-897-4632

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1963

D101.11:

READEX FICHE best copy available

Change No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *1 October 1973*

Direct and General Support and Depot Maintenance Manual

TRUCK, LIFT, FORK; GASOLINE; PNEUMATIC-TIRED WHEELS; 15,000-POUND CAPACITY; 210 IN. LIFT HEIGHT (HYSTER MODEL H150C) ARMY MODELS MHE 178, MHE 178A, MHE 178B, AND MHE 178C, FSN 3930-897-4632; (HYSTER MODEL H150F) ARMY MODEL MHE 223, FSN 3930-151-4434.

TM 10-3930-222-35, 4 December 1963, is changed as follows:

The title is changed as shown above.

Page 2. Paragraph 1*a* is superseded as follows:

1. Scope

a. This manual is for your use in maintaining the Hyster Forklift Truck, Models H150C, Army Models MHE 178, MHE 178A, MHE 178B, MHE 178C, and H150F, Army Model MHE 223.

Paragraph 7*a*(1). Tabulated data; Model . . . FS 244-6062 is changed to read "Model . . . FS 244-6098.

Page 3. Add paragraphs 7*d* and *e* as follows:

d. Alternator Specifications . . . . Army Model MHE 223.

Make	Delco Remy
Model	100 DN Series
Type	100, Neg Ground
Voltage	12
Amperage	55 at 14 V
Rotation	Clockwise (Drive End)
Brush spring tension	32 ounces

e. Voltage Regulator.

Make	Delco Remy
Voltage Setting (at 85° F.).	
Upper Points	13.8—to 14.8—Volts
Lower Points	13.7—to 14.7—Volts
Field Relay	
Air Gap	0.015 Inch
Point Opening	0.030 Inch
Closing Voltage	3.8—to 7.2—Volts (adjusted to 5.5 Volts)

Page 12. Paragraph 22*a*(2) is superseded as follows:

(2) Remove PCV tube, valve, and elbows from the exhaust and intake manifolds. Remove the intake and exhaust manifolds and gaskets.

Page 33. Paragraph 37. The paragraph title is changed to read as follows:

37. Generator (Army Model MHE 178, 178A, 178B, and 178C)

Paragraph 37.1 is added.

37.1. Alternator (Army Model MHE 223)

a. Removal and Installation. Refer to TM 10-3930-222-20.

b. Disassembly.

(1) Remove nut (item 1, fig. 24.1) and lockwasher (2). Using a puller, remove the pulley (52), from the rotor shaft.

(2) Slide the fan (53) and collar (4) from the rotor shaft.

(3) Remove the three screws (6) from the alternator case (47), and gently lift off the end frame (5).

(4) Remove the woodruff key (3) and slide the end frame (5) from the rotor (15).

(5) Remove the three screws (8) from the bearing retainer (7). Lift the bearing retainer (7), collar (9), and gasket (10), from inside of the alternator housing.

(6) Fit a short piece of pipe against the inner race of the bearing (11), and press out the bearing

(11), with an arbor press. Remove the grease slinger (12).

(7) Remove the screws and lockwashers from the stator terminal lug (14), and slide the stator (13), from the alternator case (47).

(8) Remove the screws (36), washer (37), and insulator bushings (38), from the electrical contact holder (35), and lift the electrical contact holder assembly from the alternator.

(9) Remove the electrical contact brushes (39), compression springs (40), and terminal clip (41) from the alternator case.

(10) Remove the nut (28), and washer (29) and disconnect the leads from the diodes (32 and 48), and lift off lead (34) from terminal stud (30).

(11) Remove the battery stud in the following manner: Unscrew nut (22) and remove lockwasher (23), flat washer (24), nonmetallic washer (25), from the exterior of the alternator case then pull terminal (27) from the alternator assembly.

(12) Remove the ground stud in the following manner: Unscrew nut (16), and remove lockwasher (17), flat washer (18), pull stud (21), and insulator (20), from alternator.

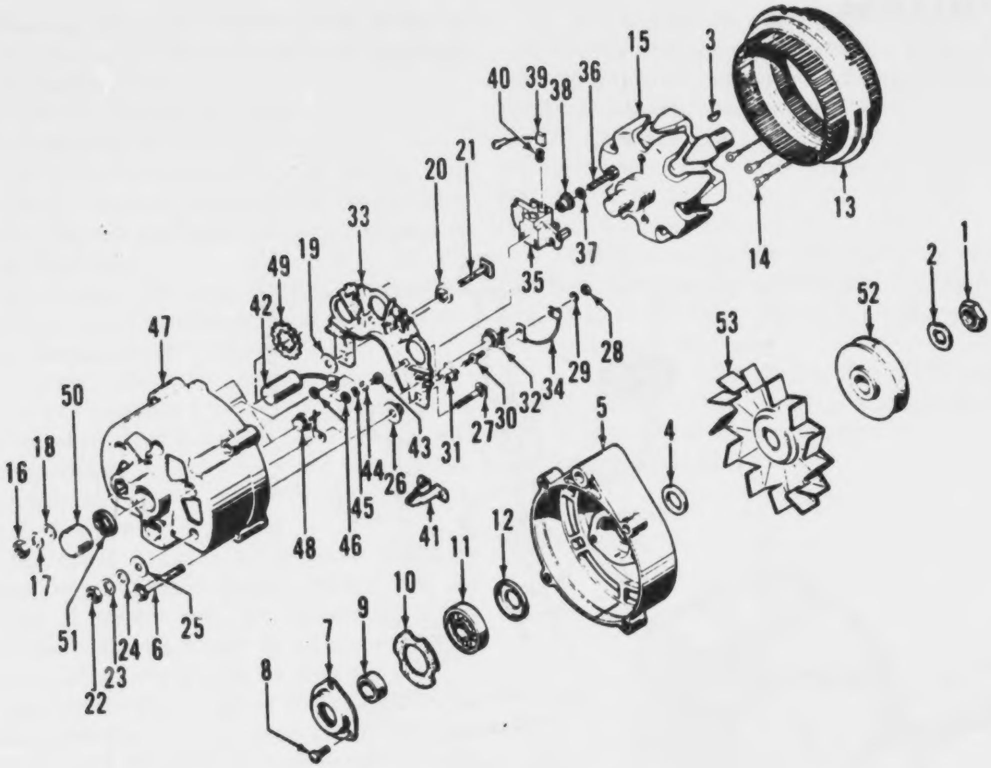
(13) When both studs (21 and 27), have been removed, lift the heatsink (33), from the case (47). Remove the fiber insulators (26), and nonmetallic washer (19), from the alternator case.

(14) Remove the screw (43), lockwasher (44), flat washer (45) and nonmetallic washer (46), and lift capacitor lead (42), from alternator case (47). Remove the spring tension washer (49), and slide the capacitor (42) from the alternator case.

(15) If one of the diodes (32 or 48), is found to be defective, replace as specified in paragraph 37.1*d* (5).

(16) To remove the bearing (50), press it out of the end frame (5). Do not tap on the bearing. Remove the seal (51).

Figure 24.1. is added.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1. NUT
2. WASHER
3. WOODRUFF KEY
4. SHAFT COLLAR
5. END FRAME
6. SCREW
7. BEARING RETAINER
8. SCREW
9. SHAFT COLLAR
10. GASKET
11. BALL BEARING
12. GREASE SLINGER
13. GENERATOR STATOR
14. LUG TERMINAL
15. GENERATOR ROTOR
16. NUT
17. WASHER
18. WASHER
19. WASHER
20. INSULATOR
21. STUD TERMINAL
22. NUT
23. WASHER
24. WASHER
25. WASHER
26. FIBRE INSULATOR
27. STUD TERMINAL
28. NUT
29. WASHER
30. STUD TERMINAL
31. TERMINAL MOUNT
32. DIODE SEMICONDUCTOR DEVICE
33. SEMICONDUCTOR DEVICE HEAT SINK
34. ELECTRICAL LEAD
35. ELECTRICAL CONTACT HOLDER
36. SCREW
37. WASHER
38. BUSHING INSULATOR
39. ELECTRICAL CONTACT BRUSH
40. COMPRESSION SPRING
41. TERMINAL CLIP
42. PAPER DIELECTRIC FIXED CAPACITOR
43. SCREW
44. WASHER
45. WASHER
46. WASHER
47. CASE
48. DIODE SEMICONDUCTOR DEVICE
49. SPRING TENSION WASHER
50. ROLLER BEARING
51. SEAL
52. PULLEY
53. FAN

ME 3930-222-35/24.1 C1

Figure 24.1. Alternator, exploded view (Army model MHE 223).

Figure 24.2 is added.

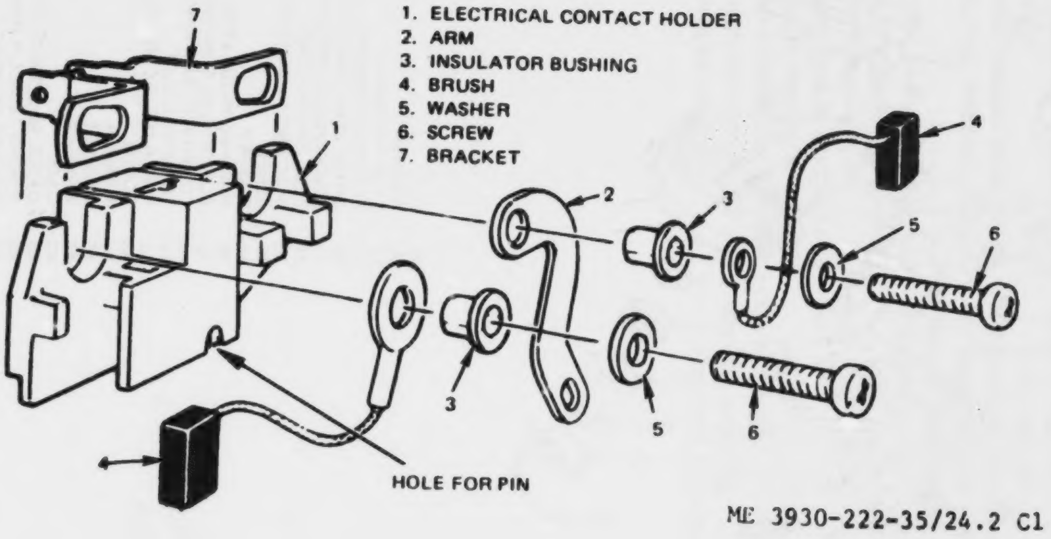

1. ELECTRICAL CONTACT HOLDER
2. ARM
3. INSULATOR BUSHING
4. BRUSH
5. WASHER
6. SCREW
7. BRACKET
7
1
2
3
4
5
6
3
5
6
HOLE FOR PIN
ME 3930-222-35/24.2 C1

Figure 24.2. Installing alternator brushes (Army model 222).

c. Cleaning. Using air hose or clean cloths, remove all dirt from component parts of alternator before inspecting them.

d. Inspection, Testing, and Repair.

(1) *Inspection of parts.*

(a) Inspect the alternator case (47, fig. 24.1) for cracks or external damage that would interfere with normal operation. If case damage, replace the alternator.

(b) Inspect for loose terminal connections and worn or frayed insulation. Tighten loose terminal nuts. Replace worn or frayed wiring.

(c) Check the ball bearing (11), to make sure that it is well lubricated. If it is in good condition, it may be reused, and should be filled 1/4 full with high-temperature grease. Check the bearing (50). Replace this bearing if it is dry. Do not attempt to re-use if it has become dry.

(d) Inspect brushes (39) to insure that they are clean, dry and make proper contact with the slip rings. If brushes are dirty, clean with a dry cloth. If the brushes are worn to an exposed length of 1/4 inch or less, replace the brushes as a set.

(e) Inspect slip rings on the rotor (15), for dirt and oxidation. If the rings are dirty, clean and polish with 400 grain or finer polishing cloth. Spin the rotor in a lathe and hold the polishing cloth against the slip rings.

(f) Inspect and check the diodes.

(2) Checking the rotor (15). The rotor may be checked electrically for grounded, open or shorted field coils as follows:

(a) To check for grounds, connect a 110 volt test lamp or an ohmmeter from either slip ring to the rotor shaft (fig. 24.3). If the lamp lights, the field winding is grounded.

(b) To check for opens, connect the test lamp to each slip ring (fig. 24.3). If the lamp fails to light, the field winding is open.

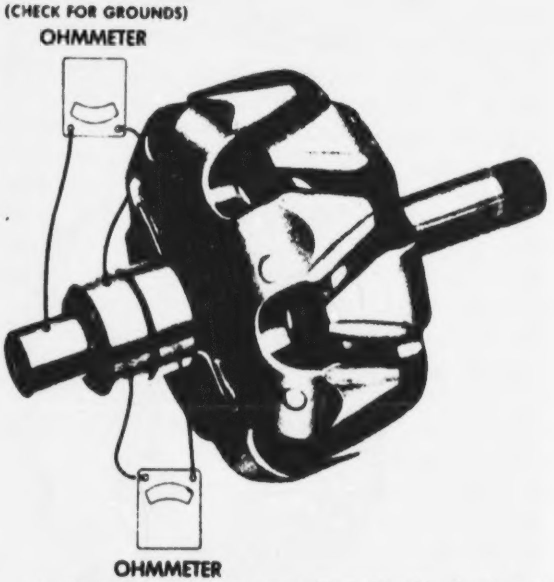
(c) To check for short-circuit, connect a 12 volt battery and ammeter in series between the two slip rings. An ammeter reading above 2.3 amperes indicates shorted windings.

(3) *Checking the stator.* To check the stator windings, remove the three stator attaching nuts (28, fig. 24.1), then separate the stator (13) from the end frame (5) if not previously done.

(a) To check for grounds, connect a 110 volt test lamp between the stator leads and the frame (fig. 24.4). If the lamp fails to light, the windings are grounded to the frame.

(b) To check for shorts, alternately connect the test lamp between the meter leads. If the lamp fails to light, the windings are open.

Figure 24.3 is added.



ME 3930-222-35/24.3 C1

MHE 223).

Figure 24.4 is added.

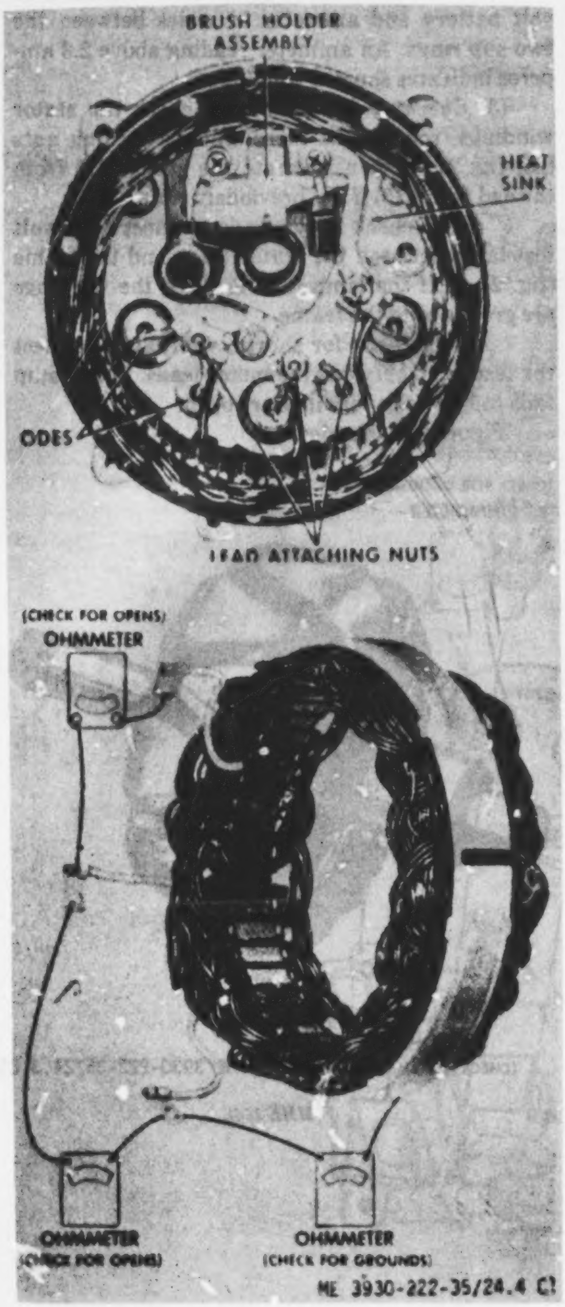

BRUSH HOLDER ASSEMBLY
HEAT SINK
ODES
LEAD ATTACHING NUTS
(CHECK FOR OPENS) OHMMETER
OHMMETER (CHECK FOR OPENS)
OHMMETER (CHECK FOR GROUNDS)
ME 3930-222-35/24.4 C1

Figure 24.4. Checking the alternator stator (Army model MHE 223).

(4) *Checking diodes.* The alternator diodes can be checked with an ohmmeter. The lowest range scale on the meter should be used, and the meter should be equipped with a 1-1/2 volt cell.

(a) With the stator leads disconnected (fig. 24.5) check any diodes in the heat sink by connecting one of the ohmmeter leads to the heat sink, and the other lead to the diode lead. Note the ohmmeter reading, then reverse the meter leads and note the reading again. If both readings are very low, or if both readings are very high, the diode is defective. A good diode will give one low reading and one high reading.

(b) To check a diode mounted in the end frame, connect one of the ohmmeter leads to the end frame, and the other ohmmeter lead to the diode lead and note the reading, fig. 24.5. Then reverse the ohmmeter lead connections and note the reading. If both readings are very low, or if both readings are very high, the diode is defective. A good diode will give one low reading and one high reading. Check the other two diodes in the end frame in the same manner.

(c) An alternate method of checking the diodes is to use a test lamp of not more than 12 volts in place of the ohmmeter. With the stator disconnected, connect the test lamp lead across each diode as described in item *b*, first in one direction and then in the other. If the lamp lights in both checks, or fails to light in both checks, the diodes are defective. When checking a good diode, the lamp will light in only one of the two checks. Do not use 110-volt test lamps to check diodes.

(5) *Replacing diodes.* The following must be observed when replacing diodes:

(a) To remove a diode, support the end frame (5, fig. 24.1) or heat sink (33) on an arbor press.

(b) Push the diodes out of the heat sink. Do not strike the diode. This may damage other diodes in the heat sink due to shock vibrations.

(c) When installing new diodes, press them into the heat sink using a tool that fits over the outer edge of the diode. Support the end frame (5) and heat sink (33) at the same time. Do not tap the diode. This may damage it and other diodes in the heat sink (33).

Figure 24.5 is added.

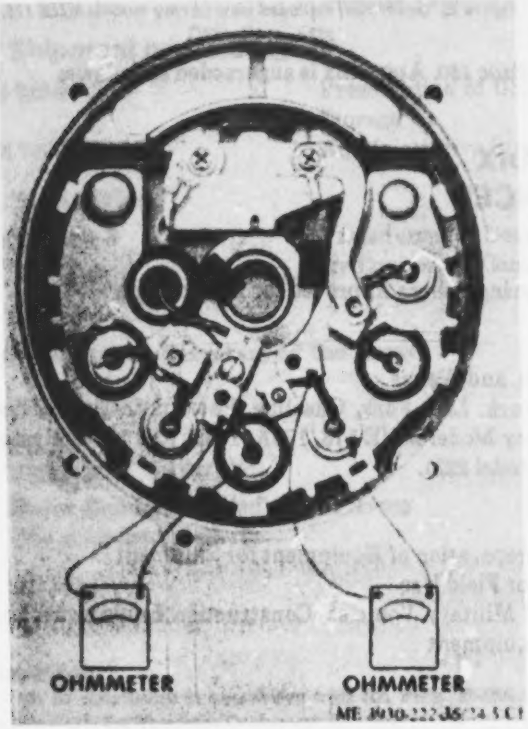


Figure 24.5. Checking alternator diodes (Army model MHE 223).

e. Assembly.

(1) Replace diodes (48).

(2) Refill bearing (11) one-quarter full with GAA. Do not over fill. Install grease slinger (12) in end frame (5) and press bearing (11) into end frame (5), with tube or pipe. Position the gasket (1), over the bearing (11), and install collar (9). Position retainer (7) over bearing assembly and install screws (8).

(3) Install seal (51). If grease supply of bearing (50) is exhausted, replace with a new bearing. Do not attempt to re-lubricate and reuse the bearing (50).

(4) Place a flat plate over the bearing (50) and press the bearing in the case (47) from the outside of the frame, until the bearing (50) is flush with the outside end. Support the inside of the end frame around the bearing bore with a suitable tool in order to prevent the end frame distortion.

(5) Install the capacitor retainer (49) on the capacitor (42) and insert the capacitor into the alternator case (47). Install the washers (46), flat washers (45), lockwasher (44), and screw (34).

(6) Place a fiber washer (19) on the inside of the case (47) over the holes marked BAT and GRD. Position the fiber insulator (26) over the small taped hole immediately below the bearing in the case (47).

(7) Place the heat sink assembly (33 and 48), in the case (47), so that the heatsink is resting on the fiber washers (19) and fiber insulator (26), with the holes in the end frame and heat-sink aligned.

(8) Install bolts (27) in the end of the heatsink and push it through the case (47). Place washers (25, 24 and 23) over thread end of bolt (27), and install nut (22).

(9) Position insulator (20) in a heatsink (33), and install bolt (21). Place washers (17 and 18), over threaded end of bolt on the outside of the case (47), and install nut (16) terminal stud (21).

(10) Position washer (46) on taped hole of heatsink (33), place end of capacitor lead (42) over washer (46) and install washers (46, 45, and 44) and screw (43) and tighten screw firmly to secure the capacitor lead to the heatsink. Position terminal clip (41) in the contact holder (35). Insert the brush (39), into the contact holder (35), and position the contact holder assembly on the end case (47). Place the terminal of each brush (39) on the terminal clip (41) and install the bushing insulator (38), washer (37), and screw (36). Insert a pin into the small hole at the bottom of the contact holder (fig. 24.1, Item 35). This will retain the brushes within the holder until the slip rings have been installed. This wire should protude through the holder and out the end of the end frame so that it can be withdrawn from the outside.

(11) Install terminal mount (31) and terminal stud (30).

(12) Connect leads (34) with washer (29) and nut (28).

(13) Install the stator assembly (13) in the case (47) and locate diode connectors over the relay, diode and stator leads and tighten the terminal nuts.

(14) Install the rotor (15) in the end frame (5) with the threaded end of the rotor shaft protruding from the end frame (5). Install the collar (4), woodruff key (3), fan (53), and pulley (52), on the rotor shaft. Position washer (2) on shaft and install nut (1). Tighten shaft nut 50 to 60 foot pounds. Do not use excessive pressure on rotor.

(15) Slide the rotor and alternator case assembly into the end frame assembly (5). Install and

tighten through bolts (6). Remove brush retainer wire.

(16) Check the alternator.

Page 36. Figure 24. The caption is superseded as follows:

Figure 24. Generator, exploded view (Army models MHE 178, 178A, 178B, 178C.

Page 130. Appendix is superseded as follows:

APPENDIX
REFERENCES

1. Fire Protection

TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users

2. Lubrication

C9100IL	Fuels, Lubricants, Oils, and Waxes
LO 10-3930-222-20	Lubrication Order; Truck, Lift, Fork, Gasoline, Pneumatic-Tired (Hyster Model H150C, Army Model MHE 178, 178A, 178B, and 178C, Hyster Model H150F, Army Model 223).

3. Painting

AR 746-1	Color, Marking, and Preparation of Equipment for Shipment
TM 9-213	Painting Instruction for Field Use
TB 746-93-1	Color and Marking of Military Vehicles, Construction Equipment, and Materials Handling Equipment

4. Cleaning

TB SIG-327	Harmful Effects of Carbon-Tetrachloride on the Human body.

5. Maintenance

TB 750-651	Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems Electric Motor and Generator Repair
TM 5-764	Electric Motor and Generator Repair
TM 9-6140-200-14	Operator, Organizational, Direct Support, General Support Maintenance Manual Storage Batteries: Lead-acid type
TM 11-483	Radio Interference Suppression
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 10-3930-222-10	Operator's Manual; Truck, Lift, Fork; Gasoline; Pneumatic-Tired Wheels 15,000-Pound Capacity (Hyster Model H150C, Army Model MHE 178, 178A, 178B, and 178C, FSN 3930-897-4632 Hyster Model 150F, Army Model 223). FSN 3930-151-4434
TM 10-3930-222-20	Organizational Maintenance Manual; Truck, Lift, Fork; Gasoline; Pneumatic-Tired Wheels, 15,000 Pound Capacity (Hyster Model H150C, Army Model MHE 178, 178A, 178B and 178C, Hyster Model H150F, Army Model 223). FSN 3930-897-4632
TM 10-3930-222-20P	Organizational Maintenance Repair Parts and Special Tool Lists; Truck, Lift, Fork; Gasoline; Pneumatic-Tired 15,000 Lb Capacity 210 in. 71 ft. Height (Hyster Model H150C, Army Model MHE 178, 178A, 178B, and 178C, Hyster Model 105F, Army Model MHE 223). FSN 3930-151-4434
TM 10-3930-222-35P	Direct and General Support and Depot Maintenance Repair Parts and Special Tool List; Truck, Lift, Fork; Gasoline; Pneumatic-Tired (Hyster Model H150C Army Model MHE178, 178A, 178B, and 178C, Hyster Model 150F, Army Model 223).

6. Testing

AMSTE-R-702-101	TECOM Test Operations Procedures, Wheeled, Tracked, and Special Purpose Vehicles

7. Shipment and Storage

TB 740-97-2	Preservation of USAMECOM Mechanical Equipment for Shipment and Storage
TM 740-90-1	Administrative Storage of Equipment

8. Demolition

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use (Mobility Equipment Command)

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A (qty rqr block No. 896) direct and general support maintenance requirements for Warehouse Equipment.

Changes in force: C 1 and C 2

TM 10-3930-222-35
C 2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *31 January 1975*

Direct Support and General Support and Depot Maintenance Manual

TRUCK, LIFT, FORK; GASOLINE; PNEUMATIC-TIRED WHEELS; 15,000-POUND CAPACITY; 210 IN. LIFT HEIGHT (HYSTER MODEL H150C, ARMY MODELS MHE 178, MHE 178A, MHE 178B AND MHE 178C)
NSN 3930-00-897-4632;
(HYSTER MODEL H150F, ARMY MODEL MHE 223)
NSN 3930-00-151-4434

Current as of 11 October 1974

TM 10-3930-222-35, 4 December 1963, is changed as follows:

The title is changed to read as shown above.

Page 2. Paragraph 4 is superseded as follows:

4. Recommendations for Maintenance Publications Improvements

You can improve this manual by recommending improvements using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and mailing the form to Commander, US Army Troop Support Comand, ATTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, MO 63120. A reply will be furnished direct to you.

Page 2. Paragraph 7*a* (2), line 6. Change "1.7470 to 1.7475 in." to read "1.2465 to 1.2475 in.".

Line 11, Delete "Inside diameter . . . 1.8755".

Add the following:

Camshaft bearing I. D.

Front	1.8745 to 1.8755 in.
Intermediate front	1.8115 to 1.8125 in.
Intermediate rear	1.7495 to 1.7502 in.
Rear	1.2495 to 1.2505 in.

Subparagraph (3), line 6. Change "1.9865 to 1.9375 in." to rear "2.0594 to 2.0601 in.".

Line 9. Change "0.001 in." to rear "0.0008 to 0.002 in.".

Subparagraph (4), line 6. Change "2.249 to 2.250 in." to read "2.2442 to 2.2451 in.".

Subparagraph (6), line 5. Change "0.007 in." to read "0.010 to 0.020 in.".

Line 7. Change "0.007 in." to read "0.010 to 0.020 in.".

Lines 9 and 10. Change "Compression (2 top rings) 0.0035 in." to read "Compression (No. 1 ring) 0.002 to 0.004 in.; (No. 2 ring) 0.0015 to 0.0035 in.".

Line 11. Change "0.003 in." to read "0.001 to 0.003 in.".

Subparagraph (7), line 6. Change "0.8592 to 0.8594 in." to read "0.8594 to 0.8596 in."

Subparagraph (11), line 4. Change "0.3357 in." to read "0.3406 in.".

Line 6. Change "0.0015 in." to read "0.0017 to 0.0035 in.".

Line 7. Change "0.0045 in." to read "0.0037 to 0.0055 in.".

Line 11. Change "30°" to read "45°".

Page 6, paragraph 13*b*. Subparagraph (2) is superseded as follows:

(2) Check flatness in at least three positions lengthwise and five crosswise. The maximum permissible out of flatness is 0.004 in. lengthwise and 0.003 in. crosswise or in localized low spots. Replace or resurface head, if not within tolerances. Minor variations up to 0.010 in. can be repaired by surface grinding or milling.

Page 17. Paragraph 28*b*. Change last sentence to read "The main bearing clearance should be 0.0008 to 0.0028."

Page 36. Paragraph 38*c*(3). Add the following sentence:

Pressures in range column for check port 1 and 4 may vary as much as 15 lbs. plus or minus."

Page 38. "Transmission Pressure Setting "table, column 3, line item 4. Add "no adjustment";

Column 5, line item 4. After "2 psi", add "MIN.".

Page 93. Paragraph 50*a*. Add (5) as follows:

(5) Before disassembly check and record ring and pinion gear back lash. If ring and pinion gears are not replaced, use recorded back lash.

Subparagraph *c* (4). Add "(Refer to TB ENG 364 for gear wear pattern.)".

Page 130. Appendix, paragraph 5. Add "TB ENG 364, Serviceability of gears."

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A (qty rqr block No. 895), Direct/General Support requirements for Warehouse Equipment.

GPO 911-791

TECHNICAL MANUAL
No. 10-3930-222-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *4 December 1963*

FIELD AND DEPOT MAINTENANCE MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL TRUCK, LIFT, FORK, GASOLINE, PNEUMATIC-TIRED WHEELS 15,000-POUND CAPACITY (HYSTER MODEL H150C, ARMY MODEL MHE 178)

FEDERAL STOCK NUMBER 3930-897-4632

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for use by personnel responsible for field maintenance (third and fourth echelons) and depot maintenance (fifth echelon) of the Truck, Lift, Fork, Gasoline, Pneumatic-Tired Wheels, 15,000-pound capacity, (Hyster Model H150C, Army Model MHE 178) Federal Stock Number 3930-897-4632, procured under contract number N600 (MIS) 57085.

b. The maintenance services described in this manual are based upon the maintenance allocation chart which is published in TM 10-3930-222-20 and the repair parts and special tools list which is published as TM 10-3930-222-35P.

2. Appendix

The appendix is a list of current references applicable to third, fourth, and fifth echelons of maintenance.

3. Forms and Records

The maintenance forms, records, and reports to be used in the field and depot maintenance of this truck are listed and described in TM 38-750.

4. Recommended Changes

Users of this manual are encouraged to submit recommended changes or comments. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided to insure understanding and complete evaluation. Comments should be submitted on DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) direct to Commandant, U. S. Army Quartermaster School, Fort Lee, Va. 23801.

5. Orientation

Throughout this manual, the use of the terms *right, left, front,* and *rear* indicates directions from the viewpoint of the operator sitting in the seat of the truck, *except that these directions do not apply to the engine after its removal from the truck.*

Section II. DESCRIPTION AND DATA

6. Description

The general description of the truck will be found in TM 10-3930-222-10 and additional descriptive material, applicable to the particular assembly, will be found in TM 10-3930-222-20.

7. Tabulated Data

a. Engine Specifications.

(1) *Overall unit.*

Make	Continental
Model	FS 244-6062
Bore	3.4375 in.
Stroke	4.375 in.
Brake horsepower	73 at 2,200 rpm (max.)
Displacement	244 cu. in.
Firing order	1-5-3-6-2-4
Cylinder compression:	
Ratio	6.9 to 1
Pressure (each cylinder, with plugs removed, at normal cranking speed and throttle wide open).	135 to 140 psi (a maximum of 10% allowable variation between cylinders).
Torque (at 1,200 rpm)	192 ft.-lb.
S.A.E. horsepower	28.4
Governed speed	2,400 rpm

(2) *Camshaft.*

Driven by	Crankshaft helical gear
Journal diameters:	
Front	1.8715 to 1.8725 in.
Intermediate front	1.8085 to 1.8095 in.
Intermediate rear	1.7457 to 1.7465 in.
Rear	1.7470 to 1.7475 in.
Sleeve bearings:	
Number	4
Type	Babbitt replaceable
Clearance	0.002 to 0.004 in.
Inside diameter	1.8755 in.
Timing gear	Timing mark should be in line with that of crankshaft timing gear to properly time valves.

(3) *Connecting rods.*

Type	Drop-forged I-beam
Number	6
Twist and bend	0.001 in. (allowable)
Sleeve bearings	Precision fit, replaceable
Journal:	
Diameter	1.9365 to 1.9375 in.
Taper or out-of-round.	0.001 in. (allowable)
Clearance (crankshaft journal-to-bearing).	0.001 in.
Torque wrench pull on nuts.	35 to 40 ft.-lb.

(4) *Crankshaft.*

Type	Counterbalanced
Thrust taken by	Front main bearing
End play	0.005 to 0.009 in.
Taper or out-of-round	0.001 in. (allowable).
Main bearings:	
Diameter	2.249 to 2.250 in.
Desired clearance	0.001 to 0.0032 in.
Taper or out-of-round.	0.0005 in. (allowable)
Torque wrench pull on capscrews.	85 to 90 ft.-lb.

(5) *Piston pins.*

Type	Floating
Diameter	0.8591 to 0.8593 in.
Fit in piston boss	Palm-push fit
Fit in connecting rod bushing.	Thumb-push fit

(6) *Piston rings.*

Number per piston:	
Compression	2
Oil	2
Gap clearance:	
Compression (2 top rings).	0.007 in.
Oil (2 lower rings)	0.007 in.
Side clearance:	
Compression (2 top rings).	0.0035 in.
Oil (2 lower rings)	0.003 in

(7) *Pistons.*

Type	Cam ground
Material	Aluminum
Cylinder diameter	3.4375 in.
Clearance (piston-to-cylinder wall).	0.003 in. feeler gage with a 5- to 10-lb. pull.
Pin hole diameter	0.8592 to 0.8594 in.

(8) *Valve guides.*

Type	Removable
Outside diameter	0.6565 (min.) to 0.6575 in. (max.).
Distance between top of guide to top of cylinder block.	$1\frac{15}{32}$ in.

(9) *Valve lifters.*

Type	Barrel
Clearance in guide	0.0005 in.

(10) *Valve springs.*

Length:	
Free	$2\frac{1}{16}$ in.
Closed	$1\frac{21}{32}$ in.
Pressure in closed position.	47 to 53 lb.

(11) *Valves.*

Type	Poppet
Stem diameter:	
Intake	0.3406 in.
Exhaust	0.3357 in.
Stem clearance in guide:	
Intake	0.0015 in.
Exhaust	0.0045 in.
Operating clearance:	
Intake and exhaust	0.014 in. (hot)
Seat angle:	
Intake	30°
Exhaust	45°

b. Generator Specifications.

Make	Delco-Remy
Model	1102221
Type	Ventilated
Voltage	12
Amperage	20 at 14 v.
Rotation (drive end)	Clockwise
Brush spring tension	28 oz.
Field coil draw:	
Volts	12
Amperes	1.62 to 1.82

c. Starting Motor Specifications.

Make	Delco-Remy
Model	1107264
Type	Barrel-solenoid
Voltage	12
Rotation	Clockwise
Brush spring tension	35 oz.
No load test:	
Volts	10.6
Maximum amperes	49
Minimum revolutions per minute.	6,200

CHAPTER 2

MAINTENANCE INSTRUCTIONS

Section I. TOOLS AND EQUIPMENT

8. Repair Parts and Special Tools

The repair parts and special tools that are authorized for use in field maintenance (third and fourth echelon) and depot maintenance (fifth echelon) of this truck are listed and illustrated in TM 10–3930–222–35P.

9. Common Tools

The common tools that are used in field maintenance (third and fourth echelon) and depot maintenance (fifth echelon) of this truck are authorized in the appropriate table of allowances.

Section II. TROUBLESHOOTING

10. General

This section contains troubleshooting information in chart form for aid in locating and correcting some of the common troubles which may develop in the transmission and torque converter. If a specific malfunction or the troubleshooting instruction is not covered herein, isolate the system in which the trouble occurs and locate the defective component. When troubleshooting information on systems other than the transmission and torque converter is needed, refer to TM 10–3930–222–20.

11. Procedures

Troubles and troubleshooting procedures in chart form are shown in figure 1. Read the chart from left to right. The troubles are listed in the first block. Follow the directions in the succeeding blocks until the defects are located.

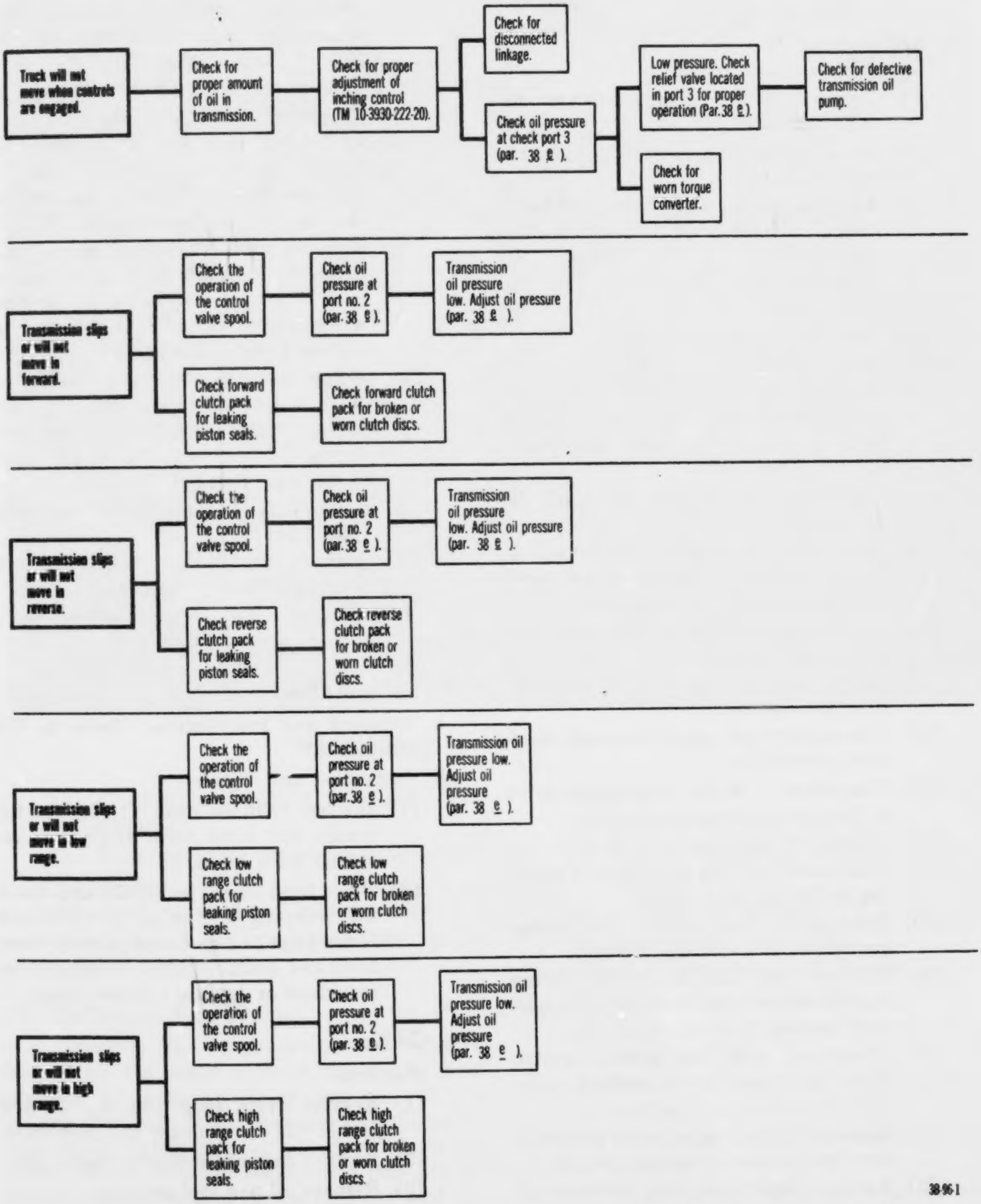
Truck will not move when controls are engaged.
Check for proper amount of oil in transmission.
Check for proper adjustment of inching control (TM 10-3930-222-20).
Check for disconnected linkage.
Check oil pressure at check port 3 (par. 38 e).
Low pressure. Check relief valve located in port 3 for proper operation (Par. 38 e).
Check for defective transmission oil pump.
Check for worn torque converter.
Transmission slips or will not move in forward.
Check the operation of the control valve spool.
Check oil pressure at port no. 2 (par. 38 e).
Transmission oil pressure low. Adjust oil pressure (par. 38 e).
Check forward clutch pack for leaking piston seals.
Check forward clutch pack for broken or worn clutch discs.
Transmission slips or will not move in reverse.
Check the operation of the control valve spool.
Check oil pressure at port no. 2 (par. 38 e).
Transmission oil pressure low. Adjust oil pressure (par. 38 e).
Check reverse clutch pack for leaking piston seals.
Check reverse clutch pack for broken or worn clutch discs.
Transmission slips or will not move in low range.
Check the operation of the control valve spool.
Check oil pressure at port no. 2 (par. 38 e).
Transmission oil pressure low. Adjust oil pressure (par. 38 e).
Check low range clutch pack for leaking piston seals.
Check low range clutch pack for broken or worn clutch discs.
Transmission slips or will not move in high range.
Check the operation of the control valve spool.
Check oil pressure at port no. 2 (par. 38 e).
Transmission oil pressure low. Adjust oil pressure (par. 38 e).
Check high range clutch pack for leaking piston seals.
Check high range clutch pack for broken or worn clutch discs.
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Figure 1. Transmission and torque converter truboleshooting chart.

Section III. ENGINE (GROUP 01)

12. Engine Unit (Overall)

a. Removal.

(1) Disconnect battery.

(2) Remove floor plates.

(3) Remove seat support.

(4) Remove hood. (Refer to TM 10-3930-222-20.)

(5) Drain coolant from radiator and engine crankcase.

(6) Remove upper and lower radiator hoses. (Refer to TM 10-3930-222-20.)

(7) Remove fan. (Refer to TM 10-3939-222-20.)

(8) Remove radiator (par. 35).

(9) Drain engine oil.

(10) Remove four capscrews and lockwashers and separate the hydraulic pump drive shaft from the crankshaft pulley.

(11) Disconnect the choke cable at the carburetor.

(12) Disconnect the accelerator linkage at the carburetor. Disconnect fuel tank-to-fuel pump line at fuel pump.

(13) Disconnect and tag battery lead wire at voltage regulator.

(14) Disconnect and tag wire at temperature sending unit.

(15) Disconnect and tag wire at oil pressure transmitter.

(16) Disconnect and tag hour meter wire at hour meter pressure switch.

(17) Disconnect and tag wire at coil.

(18) Disconnect and tag two wires at starting motor solenoid switch.

(19) Remove clip that secures the wiring harness to the starting motor.

(20) Remove clips that secure the wiring harness at two places on the transmission housing.

(21) Disconnect and tag neutral switch wires at transmission control valve (fig. 2).

(22) Disconnect and tag wires at transmission temperature warning switch.

(23) Remove capscrews and lockwashers that secure muffler to exhaust elbow.

(24) Straighten lock plates and remove capscrews that secure yoke fitting to cross and bearing assembly and separate propeller shaft from yoke fitting at transmission.

(25) Disconnect transmission linkage at the control valve (fig. 2).

(26) Disconnect inlet and outlet hydraulic lines at auxiliary hydraulic pump.

(27) Remove the nut that secures engine to each rear engine support.

(28) Remove nuts, washers, spacers, lockwashers, and pads from front engine mounting on each side of engine. After engine assembly is raised from supports, remove spacers.

(29) Using suitable hoist and chains, remove engine assembly, with the torque converter and the transmission attached, from truck (fig. 3) and place on suitable stand.

(30) Remove the transmission assembly (par. 38*a*).

(31) Remove the torque converter and housing assembly (par. 43*a*).

b. Installation. Reverse procedure in *a* above.

13. Cylinder Head

a. Removal and Installation. Refer to TM 10-3930-222-20.

b. Inspection and Repair.

(1) Inspect cylinder head (1, fig. 4) for cracks and sand holes after it is removed from block.

(2) Place head on surface plate and check for warping by using a 0.012-inch feeler gage as a go-no-go gage between head and surface plate. If gage goes, resurface or replace cylinder head.

14. Oil Pan

a. Removal.

(1) Remove drain plug (26, fig. 4) and gasket (27) and drain the crankcase.

(2) Remove assembled washer bolts (28).

(3) Remove oil pan and gaskets.

b. Cleaning and Repair.

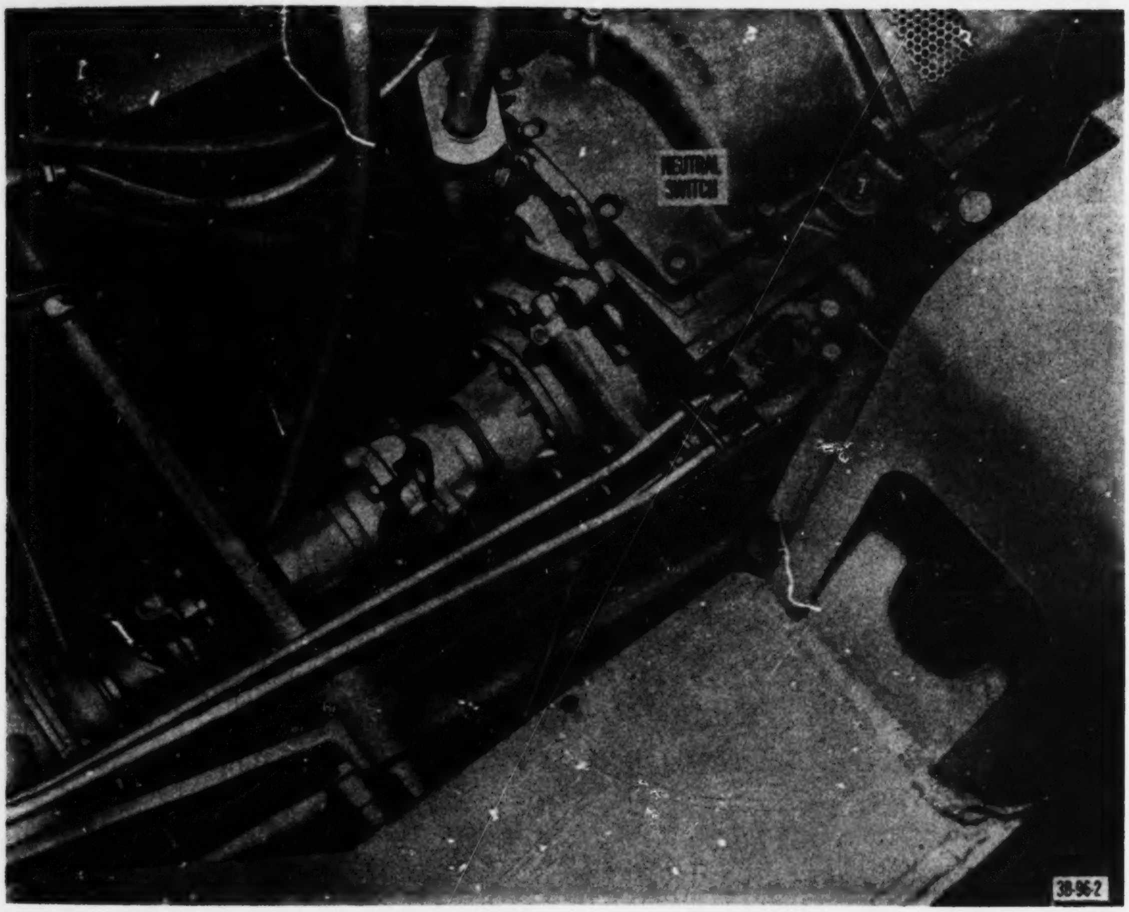


Figure 2. Transmission control valve and linkage.

(1) Clean oil pan with SD (solvent, dry-cleaning).

(2) Beat out dents using a hammer and a block.

(3) Braze or weld any minor cracks.

c. Installation. Reverse procedure in *a* above, using new gasket.

15. Oil Pressure Relief Valve

a. General. The oil pressure relief valve is located on the right side of the engine and opens at 45 to 50 pounds of pressure. If the oil pressure gage is not defective and the pressure shown is less than 45 pounds at operating speed, the oil pressure relief valve may not be seated properly and must be removed and inspected.

b. Removal.

(1) Remove the plug (32, fig. 4).

(2) Remove adjusting washers if there are any.

(3) Remove the spring.

(4) Remove the valve (34).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with SD.

(2) Check to see that plug threads are in good condition.

(3) Check to see that the adjusting washers are present.

(4) Check the spring for breakage and fatigue.

(5) Examine the valve for wear or mechanical defects.

Figure 3. Removing engine assembly, torque converter, and transmission.

(6) Replace any of these parts that are unserviceable.

d. Installation. Reverse procedure in *b* above.

e. Adjustment.

(1) Add washers to increase pressure.
(2) Remove washers to decrease pressure.

16. Oil Pump Assembly

a. Removal and Disassembly.

(1) Remove oil pan (par. 14).
(2) Remove nut and lockwasher from pump-to-bearing cap stud and remove oil pump from cylinder block.
(3) Remove the wire securing screen to pump, and remove screen.

b. Cleaning and Inspection.

(1) Clean parts with SD.
(2) Inspect parts for serviceability and, if found unserviceable, replace pump.

c. Assembly and Installation. Reverse procedure in *a* above.

17. Fan Drive Pulley

a. Removal.

(1) Remove radiator (par. 35).
(2) Remove main pump drive shaft (par. 59*a*).
(3) Remove fan belt (TM 10-3930-222-20).
(4) Remove screw and washer that secure pulley to crankshaft and remove pulley.

b. Installation. Reverse procedure in *a* above.

18. Timing Gear Cover

a. Removal.

(1) Remove fan drive pulley (par. 17).

(2) Remove governor (par. 34).

(3) Remove capscrews that secure timing gear cover to front engine mount and block up front of engine.

(4) Remove timing gear cover attaching capscrews (9 and 15, fig. 5) and lockwashers (8 and 19).

(5) Remove timing gear cover (7) and gasket (6).

(6) If necessary, remove the timing gear cover seal (14) by tapping it out.

b. Installation. Reverse procedure in *a* above and replace seal and gasket.

19. Camshaft Timing Gear

a. Removal.

(1) Remove timing gear cover (par. 18).

(2) Straighten tine on key washer (fig. 6).

(3) Remove self-locking nut.

(4) Use a gear puller and remove camshaft timing gear.

b. Inspection. Inspect gear for wear, cracks, or chipped teeth. Replace gear if necessary.

c. Installation. Reverse procedure in *a* above, making sure that timing marks on camshaft and crankshaft gears are properly alined (fig. 6).

20. Crankshaft Timing Gear

a. Removal.

(1) Remove camshaft timing gear (par. 19).

(2) Remove crankshaft timing gear with a puller.

b. Inspection. Inspect gear for wear, cracks, and chipped teeth. Replace gear if necessary.

c. Installation. Reverse procedure in *a* above, making sure that timing marks (fig. 6) on crankshaft and camshaft gears are properly alined.

21. Camshaft

a. Removal.

(1) Remove engine (par. 12).

(2) Remove oil pump assembly ((1) and (2), par. 16*a*).

(3) Remove camshaft gear (par. 19).

(4) Remove woodruff key (6, fig. 7).

(5) Remove thrust plate attaching bolts (7) and lockwashers (3).

(6) Remove thrust plate (2).

(7) Be sure that all valve lifters have been raised and securely tied.

(8) Pull camshaft (1) forward to remove it.

b. Inspection and Service.

(1) Mount camshaft in V-blocks, and measure for alinement and out-of-round with a dial indicator as camshaft is rotated.

1	Head, cylinder
2	Plug, pipe
3	Rod, gage, liquid level
4	Nut, plain
5	Washer, flat
6	Stud
7	Cap assembly, oil filler
8	Nipple, pipe, oil filler
9	Cock, drain, cylinder block
10	Dowel, ring, front end plate
11	Cap, bearing, front
12	Cap, bearing, front intermediate
13	Cap, bearing, rear intermediate
14	Cap, bearing, rear
15	Plug, pipe
16	Pin, straight, headless
17	Bushing, sleeve, bearing cap, rear intermediate
18	Washer, flat
19	Capscrew
20	Capscrew
21	Gasket, oil pan side
22	Block, filler, front
23	Lockwasher
24	Capscrew
25	Gasket, filler block-to-oil pan
26	Plug, magnetic, drain
27	Gasket, drain plug
28	Bolt, assembled washer
29	Pan, oil
30	Spring, helical, compression
31	Gasket, relief valve plug
32	Plug, relief valve
33	Washer, flat, adjusting, relief valve
34	Valve, oil pressure relief
35	Capscrew
36	Lockwasher
37	Block, filler, rear
38	Stud, plain
39	Nut, sleeve
40	Gasket, valve chamber cover nut
41	Cover assembly, valve chamber
42	Gasket, valve chamber cover
43	Stud, plain, end
44	Plug, fusible
45	Plug, expansion
46	Stud
47	Gasket, cylinder head

Figure 4. Engine block, head, and oil pan, exploded view.

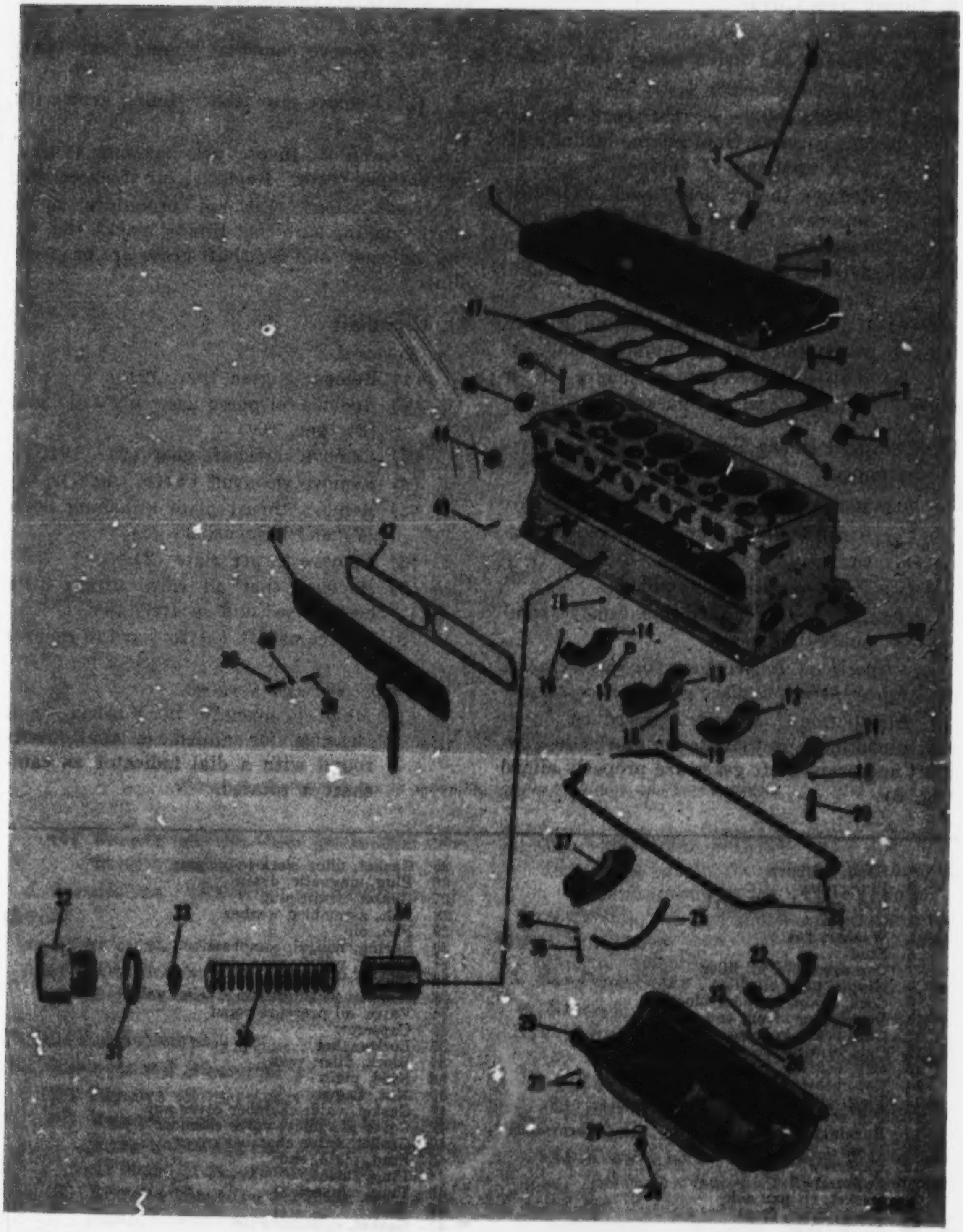
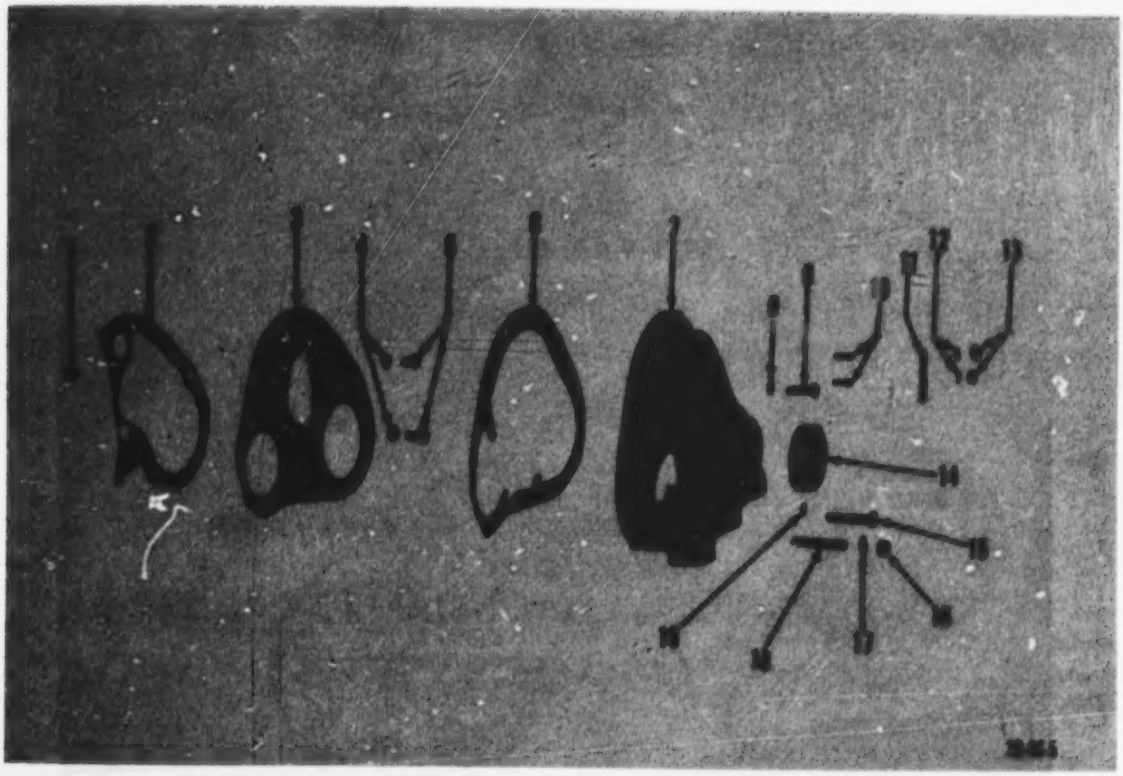


Figure 4—Continued.



1 Dowel, ring, front end plate
2 Gasket, front end plate
3 Plate, front end
4 Lockwashers
5 Capscrews
6 Gasket, cover
7 Cover, timing gear
8 Lockwasher
9 Capscrew
10 Studs, plain
11 Plate, marker
12 Lockwashers
13 Nuts
14 Seal, plain, incased, cover
15 Capscrew
16 Nut
17 Lockwasher
18 Stud
19 Washer, flat

Figure 5. Timing gear cover, exploded view.

(2) Use an outside micrometer to measure the diameter of each camshaft journal. If journal wear exceeds 0.002 inch, install new camshaft.

(3) Use an inside micrometer or telescope gage, and measure camshaft sleeve bearings (8, 9, 10, and 11, fig. 7). If clearance is not to specifications listed in paragraph 7, install new sleeve bearings at all journals. Be certain that oil passages are alined and open.

(4) Inspect thrust plate and cams for wear; inspect journals and cams for scoring.

c. Installation.

(1) If sleeve bushings were removed for replacement, press bearings into position with a suitable bearing press.

(2) Oil the camshaft journals and sleeve bearings and ease camshaft into position in cylinder block. The rear end of the camshaft must be supported and guided to prevent damage.

(3) Untie the valve lifters and return them back into position.

(4) Reverse procedures (1) through (6) in *a* above.

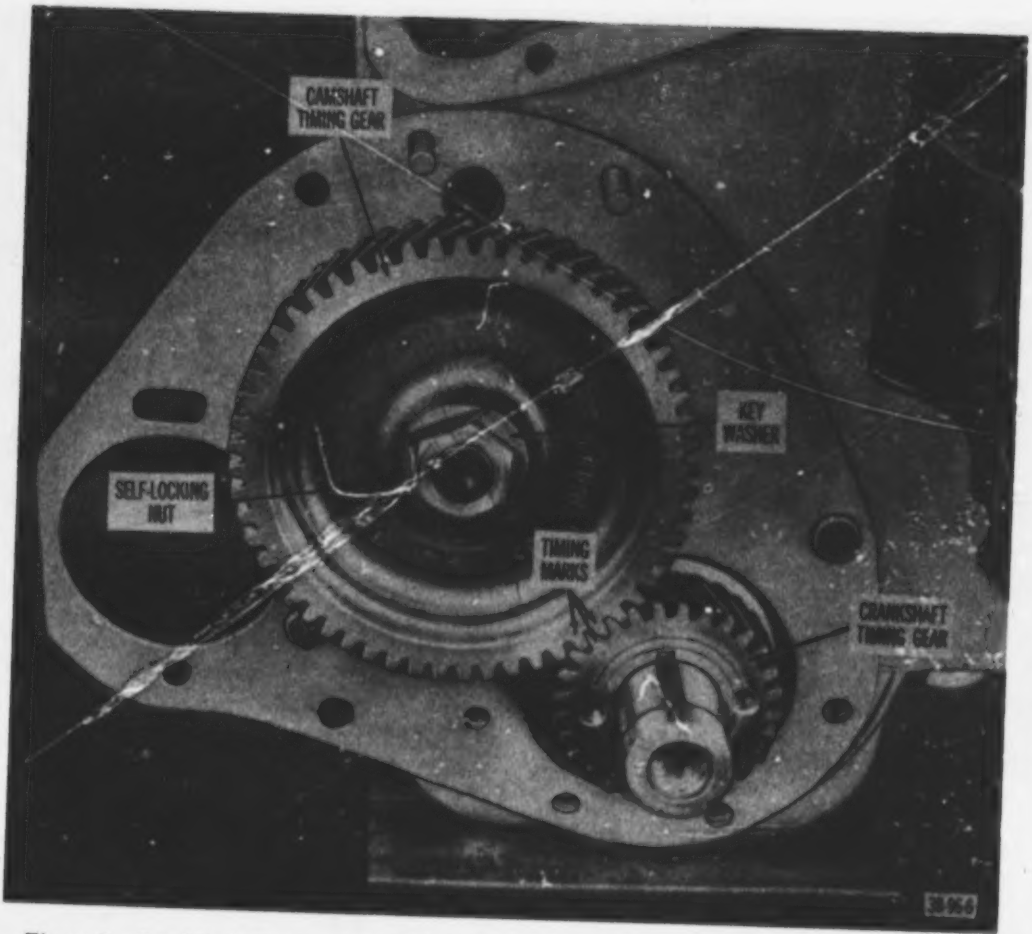


Figure 6. Crankshaft and camshaft timing gears, showing correct alinement of timing marks.

22. Valves

a. Removal.

(1) Remove cylinder head (TM 10–3930–222–20).

(2) Remove intake and exhaust manifolds and gaskets (TM 10–3930–222–20).

(3) Remove valve cover-to-cylinder block studs, sleeve nuts, and valve chamber cover and gasket.

(4) Using valve spring compressor (fig. 8), and with valve in closed position, compress spring and remove the valve spring locks.

(5) Remove spring compressor.

(6) Remove valve (1, fig. 9), valve spring (7), valve spring seat (8), and cap (9).

(7) Repeat procedure in (4) through (6) above for the other valves.

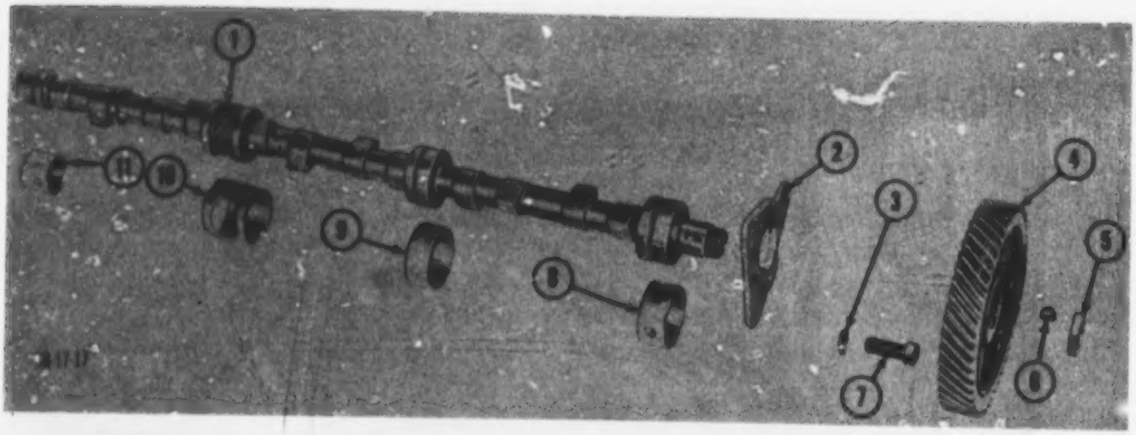
(8) Tag each valve so it may be installed in opening from which it was removed.

b. Cleaning and Inspection.

(1) Clean valves with SD. Use a wire wheel to remove carbon from valve face, seat face, and from under head of valve.

(2) After valves are thoroughly cleaned, inspect them for evidence of burns, correct margin, pits, grooves, cracks, stem wear, lock or groove wear, and warping.

(3) If it is necessary to grind exhaust valve faces, set chuck or refacing machine for 45° seat angle. For intake



1 Camshaft
2 Plate, thrust
3 Lockwasher, thrust plate bolt
4 Gear, timing
5 Nut, self-locking, gear-to-camshaft
6 Key, woodruff
7 Bolt, thrust plate
8 Bearing, sleeve, front
9 Bearing, sleeve, intermediate front
10 Bearing, sleeve, intermediate rear
11 Bearing, sleeve, rear

Figure 7. Camshaft, exploded view.

valve, set chuck for 30° seat angle. Grasp valve on unworn portion of stem, close to head, and grind valve as follows:

(*a*) Position chuck so that contact is just barely made between grinding wheel and valve face. Feeding wheel slowly into valve, make a very light cut around entire valve face, always keeping valve in contact with grinding wheel. If the cut removes metal from one-half of valve face or less, inspect chucking (gripping) of valve. If inspection reveals valve is squarely mounted, valve is misalined and must be discarded. If mounting is faulty, check valve squarely and repeat operation. When face is ground evenly on circumference, the valve alinement is satisfactory.

(*b*) After first cut has proved satisfactory, proceed with grinding operation. Do not take heavy cuts or remove more metal than necessary to remove all imperfections.

(*c*) When valve face has been ground, remove valve and check margin for minimum thickness of 3/64 inch at any point. If margin is satisfactory, place valve in its position in rack and grind remaining valves, using above procedure. If any margin is below minimum, discard valve and install a new one.

c. Installation. Reverse procedure in *a* above.

d. Adjustment. Refer to TM 10-3930-222-20.

23. Valve Guides

a. Inspection and Cleaning.

(1) Remove valve ((1) through (6), par. 22).

(2) Inspect guide for wear and carbon deposits. If carbon is excessive, clean out with brush and/or proper size reamer. If guide is worn excessively so that valve stem clearance does not meet specifications (par. 7), replace guide (*b* and *c* below).

b. Removal.

(1) With valve removed (*a* above), remove valve lifter adjusting screw.

(2) Using a suitable drift, knock valve guide (5, fig. 9) down until lower end approaches valve lifter, and remove guide.

(3) Repeat procedures in (1) and (2) above for the remaining guides.

c. Installation. Mark point on driving mandrel 1 15/32 inches from driving end, position

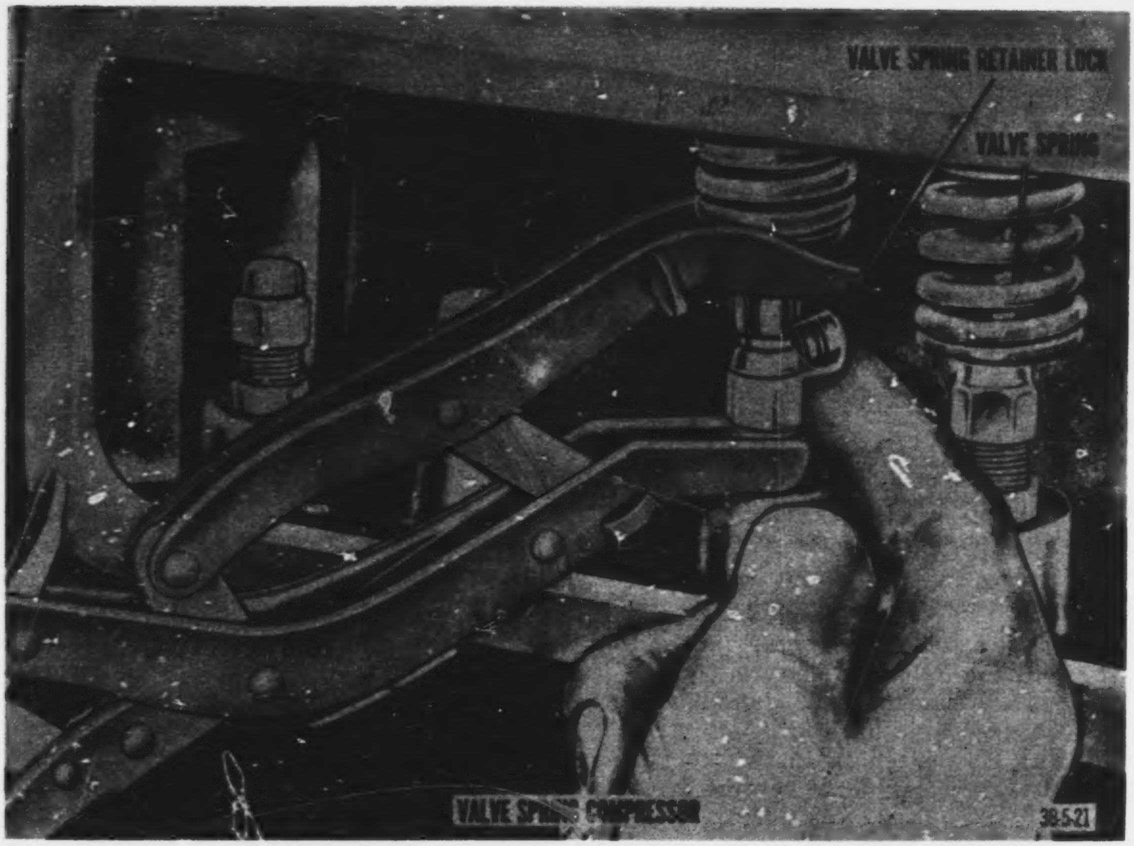


Figure 8. Compressing valve spring.

new valve guide, and drive in until top of guide is $1\frac{15}{32}$ inches from top of cylinder block. A small amount of lubricant may be used to ease installation.

24. Exhaust Valve Seats

a. Inspection.

(1) Remove valves (par. 22*a*).

(2) Be sure valve guide has been cleaned or replaced, as necessary (par. 23*a*).

(3) Inspect each exhaust valve seat for pitting, signs of fracture, and distortion from valve pounding.

(4) Replace an exhaust valve seat that is cracked, deeply pitted, or loose with a 0.010 inch oversize seat, following instructions in *b* and *c* below.

b. Removal.

(1) Remove valve seat with a valve seat puller.

(2) If a puller is not available, drill two opposing holes through the seat. Then break the seat with a chisel and remove in two halves.

Note. Do not permit drill to pass through seat and into counterbore of cylinder block.

c. Installation.

(1) Measure outer diameter of oversize seat at room temperature and cut new valve seat counterbore in cylinder block 0.0035 inch smaller in diameter than seat to be installed, using a valve seat cutting tool.

(2) Clean all cuttings from counterbore valve port and shrink oversize seat by chilling in dry ice for not less than 20 minutes.

(3) After chilling, quickly drive seat into counterbore, using seat driving tool or a soft-faced hammer.

(4) Check for correct angle of valve seat. If it is necessary to change the angle of the valve seat, proceed as follows:

(*a*) Close off all cylinder block openings to keep grinding dust out.

(*b*) Lubricate grinder pilot and install pilot firmly in valve guide.

(*c*) Position grinder on pilot; take successive light cuts until valve seat face is free of all defects and not less than $\frac{1}{16}$ inch wide at narrowest point.

(*d*) Check angle of valve and seat after grinding first seat; then grind remaining intake or exhaust seats using correctly dressed stone. Using correct stones, grind all exhaust valve seats, then all intake valve seats.

(*e*) Apply a small amount of valve-grinding compound on face of new or reconditioned valve; install small spring on stem; and place valve in its proper port. Using a valve lapper, rotate valve back and forth on the valve seat. Release pressure so that spring forces valve up, turn valve a few degrees, and turn back and forth a few more times. Lift out valve and clean valve seat with SD. Check to see that valve is seating properly.

(5) Repeat the procedure in (4) above for the other valve seats.

(6) Install valves (par. 22*c*).

25. Valve Lifters

a. Removal.

(1) Remove valve ((1) through (6), par. 22*a*).

(2) Turn adjusting screw (10, fig. 9) in slightly and lift the valve lifter assembly out through valve opening.

(3) Follow the procedure in (1) and (2) above to remove the other lifters.

b. Installation. Reverse procedures in *a* above.

26. Valve Springs and Locks

a. Removal. Follow procedure in paragraph 22*a*.

b. Testing.

(1) Test springs with spring tester to be sure that they show 47 to 53 pounds pressure at $1\frac{21}{32}$ inches.

(2) Check valve spring retainer locks (3, fig. 9) for any cracks, chips, or other defects.

(3) If defects are found in locks or springs, replace with new ones.

c. Installation. Reverse procedure in *a* above.

27. Crankshaft

a. Removal.

(1) Remove engine from truck (par. 12*a*).

(2) Remove oil pump (par. 16*a*).

(3) Remove converter adapter plate (21, fig. 10) and hub (17) from crankshaft (11).

(4) Remove engine rear end plate by removing attaching capscrews and lockwashers.

(5) Remove timing gear cover (par. 18*a*).

(6) Remove the cotter pins (12) and nuts (13) from bolts (5) and take off lower half of rod connecting assembly (4) with sleeve bearing.

(7) Push rod assembly (4) and piston (2) to top of cylinder.

(8) Repeat (6) through (7) above for remaining five pistons.

(9) Remove rear filler block (37, fig. 4) and seal by taking out two bolts and washers.

---

1 Valve, poppet, intake
2 Valve, poppet, exhaust
3 Locks, spring retainer
4 Seat, exhaust valve
5 Guide, valve stem, intake
6 Guide, valve stem, exhaust
7 Springs, valve
8 Seats, valve spring
9 Caps, valve stem
10 Screws, adjusting, valve lifter
11 Lifters, valve

Figure 9. Engine valves, exploded view.

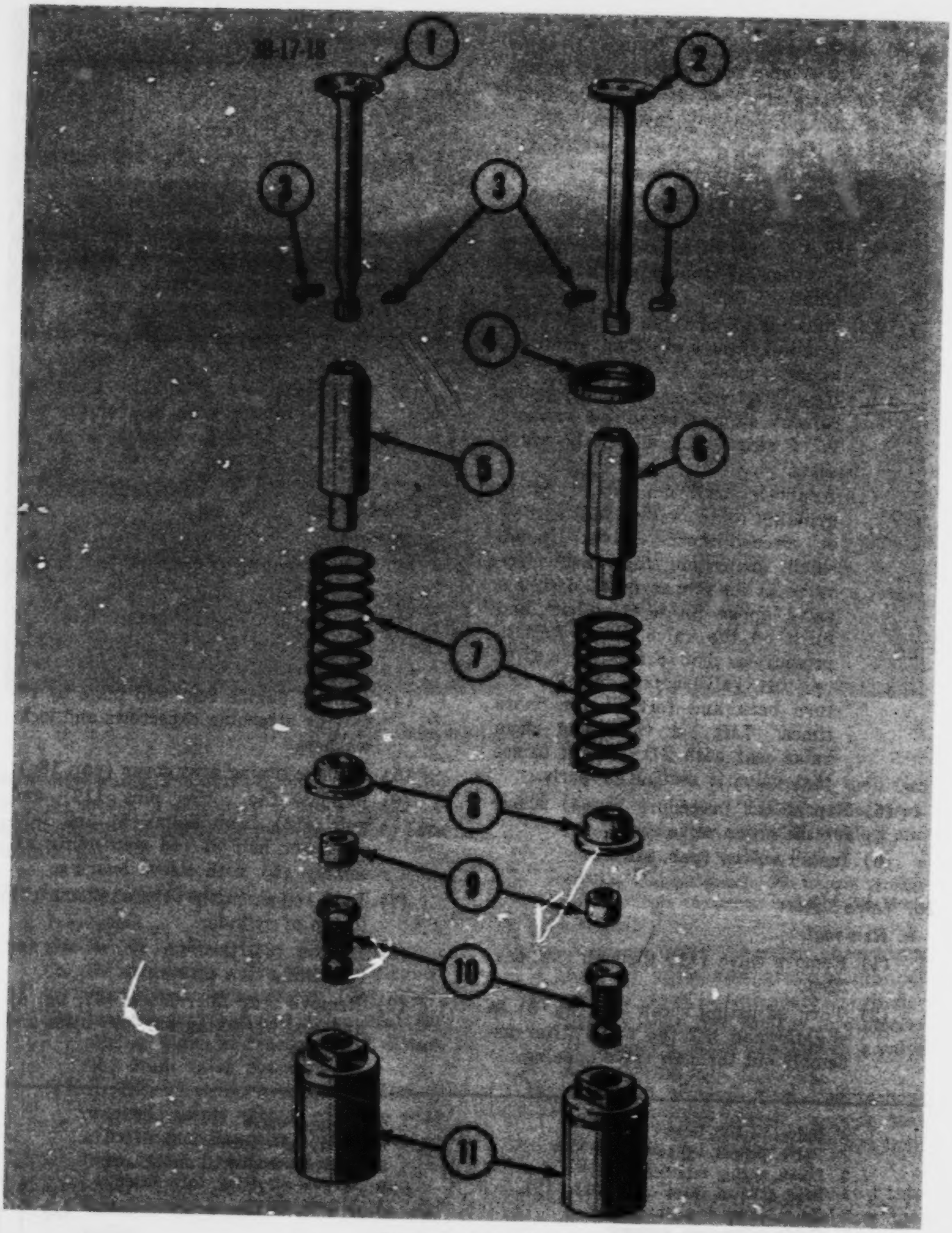

38-17-18
1
2
3
3
3
4
5
6
7
8
9
10
11

Figure 9—Continued.

(10) Remove front filler block (22) and seal by taking out two bolts and washers.

(11) Punch-mark the main bearing caps and the cylinder block to assure correct installation (fig. 11).

(12) Remove lock wires and take out two bolts and washers from each cap (11, 12, 13, and 14, fig. 4). Note punch marks on bearing caps (fig. 11).

(13) Lift bearing caps off dowel pins.

(14) Lift out the crankshaft and press off crankshaft timing gear if necessary.

b. Inspection and Service.

(1) Mount crankshaft in V-blocks, and use dial indicator to check alinement.

(2) Measure crankshaft journals at opposite points at several places, using a micrometer. Replace crankshaft if taper or out-of-round at journals exceeds 0.001 inch.

(3) Inspect crankshaft oil passages. Make certain that they are free and unobstructed. Clean with compressed air and wire brush, if necessary.

c. Installation. Reverse procedure in *a* above. Tighten connecting rod nut to 35 to 40 foot-pounds torque and crankshaft bearing capscrews to 85 to 90 foot-pounds torque.

d. End Play. After crankshaft has been installed, mount a dial indicator against some vertical surface of the crankshaft, and use a pry bar to move the crankshaft back and forth. Use the indicator to measure the end play. Normal end play is 0.005 inch to 0.009 inch. If end play is excessive, remove the front main bearing; replace it with a new one and check end play again.

28. Crankshaft Bearings

a. Replacement. The engine is equipped with sleeve bearings which may be replaced in the manner and order indicated below without removel of the crankshaft.

(1) Remove engine from truck (par. 12*a*).

(2) Remove oil pump (par. 16*a*) and inlet and outlet pipes.

(3) Remove spark plugs if cylinder head is installed.

(4) Remove crankshaft cap bolts, and remove crankshaft bearing caps together with lower halves of crankshaft bearing.

(5) Insert a bearing-removing tool through oil-hole in crankshaft journal. Rotate crankshaft by hand so that tool forces upper half of bearing out of crankcase. Be sure to turn the crankshaft so that the lock (stamped ear) on the bearing half is raised out of its notch. Repeat for all bearings.

(6) Do not ream, scrape, or burnish crankshaft bearings. Replace bearing halves in pairs if they are in any way defective.

(7) Coat new bearing halves with OE and insert in same manner as old halves were removed.

b. Clearance. Crankshaft bearing clearance should be checked after new bearings halves have been installed. Measurement should be taken with seals removed. The main bearing clearance should be 0.001 to 0 0032 inch.

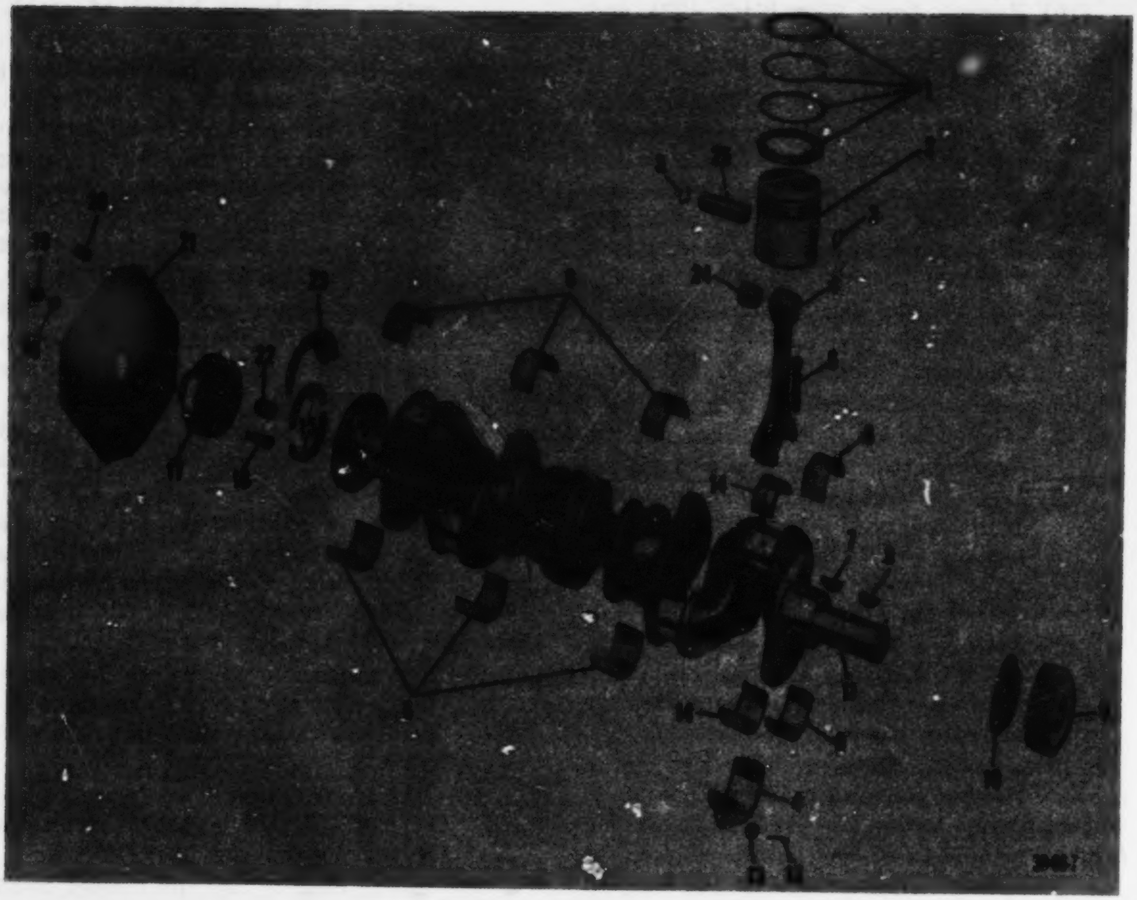
(1) When checking a bearing for clearance, all other bearings must be installed with caps tightened firmly in place.

(2) Remove bearing cap and place a piece of 0.002- by ½- by 1-inch shimstock in bearing cap (fig. 12).

(3) Install bearing cap and tighten to 85 to 90 foot-pounds, using a torque wrench. If crankshaft rotates with a noticeable drag, clearance is correct.

(4) Clearance may be checked by plastigage method if plastigage and special measuring gage are available. If this method is used, do not rotate crankshaft with plastigage in place.

c. Fitting Crankshaft Bearings. Install new crankshaft bearing caps if original caps have become damaged or broken. Do not file, dress down, or shim a bearing cap (crankshaft or connecting rod) except when installing a replacement cap, and then only for its original installation in the engine. Replacement caps conform to original caps in every respect, with the exception of stud holes which are 1/64 inch larger, and bearing cap size which is 1/16 inch shorter. The caps must thus be properly fitted by shimming or filing to obtain bearing clearance.



1 Ring set, piston
2 Piston
3 Rings, retaining, piston pin
4 Rod assembly, connecting
5 Bolt, machine, connecting rod cap
6 Bearing set, crankshaft
7 Key, woodruff
8 Key, woodruff
9 Gear, timing
10 Plate, thrust
11 Crankshaft
12 Pin, cotter
13 Nut, slotted, hexagon
14 Bearing, sleeve, connecting rod
15 Seal, rear bearing filler block
16 Bolt, converter hub and plate
17 Hub, converter-to-crankshaft
18 Lockwasher
19 Nut
20 Spacer, converter mounting
21 Plate, adapter, converter housing-to-cylinder block
22 Bearing, sleeve, crankshaft pilot
23 Guard, rear bearing oil seal
24 Bearing, sleeve, piston pin
25 Pin, piston

Figure 10. Crankshaft, connecting rod, and piston, exploded view.

29. Connecting Rods and Bearings

a. Removal.

(1) Block truck up at suitable working height.

(2) Remove cylinder head (TM 10-3930-222-20).

(3) Remove oil pan (par. 14*a*).

(4) Remove the cotter pins (12, fig. 10) and nuts (13) from bolts (5), and take off lower half of connecting rod assembly (4) with sleeve bearing (14).

(5) Push out connecting rod assembly (4) and piston (2) with ring set (1) and the upper sleeve bearing half (14) through top of cylinder.

(6) Repeat steps (4) and (5) for remaining five pistons.

(7) Remove sleeve bearings from connecting rod assembly halves.

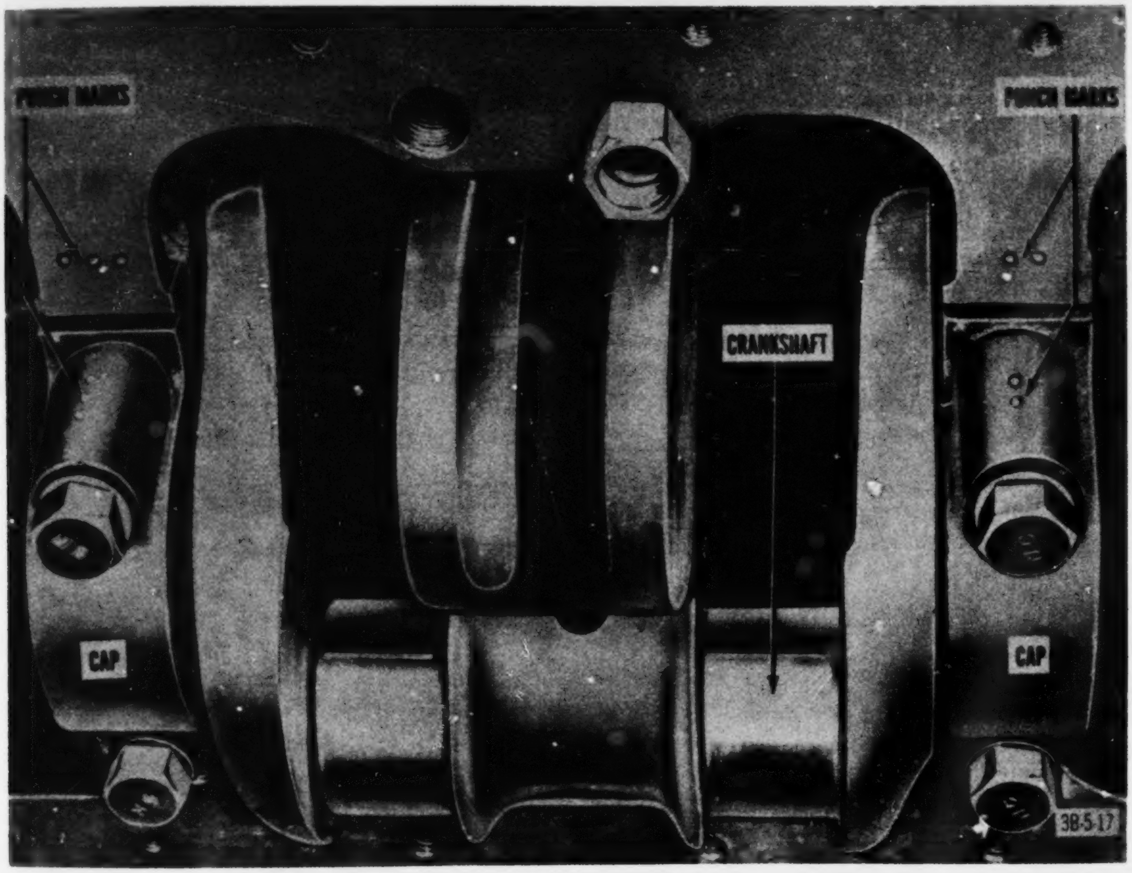


Figure 11. Punch marks on cylinder block and crnakshaft bearing caps.

(8) Remove piston pin retaining rings (3, fig. 10) from pistons, and push piston pins (25) from connecting rods and pistons.

b. Inspection and Repair.

(1) Clean all parts with SD.

(2) Inspect for pitting, scoring, or excessive wear of connecting rod sleeve bearing.

(3) Check alinement of each connecting rod with a rod alining fixture and straighten each connecting rod with arbor press or connecting rod straightening tool (B, fig. 13), as necessary, to bring upper and lower bores parallel within 0.002 inch and to remove twist (A, fig. 13) to within 0.002 inch.

(4) Replace bearings if recommended clearance (0.001 inch) is not within specifications. Check clearance by inserting a well oiled brass shim (½ inch wide by 1 inch long by 0.002 inch thick) between bearings and crankshaft journals. Using a torque wrench, tighten cap bolt nuts (13, fig. 10) to 35 to 40 pound-feet of pressure, and rotate crankshaft. If there is stiff resistance while the crankshaft is turning, the bearing clearance is not excessive.

c. Installation. When installing bearings, make certain that connecting rod bearing seats are clean. Coat connecting rod bearings with OE and make certain that bearing lugs engage slots and that oil holes are alined.

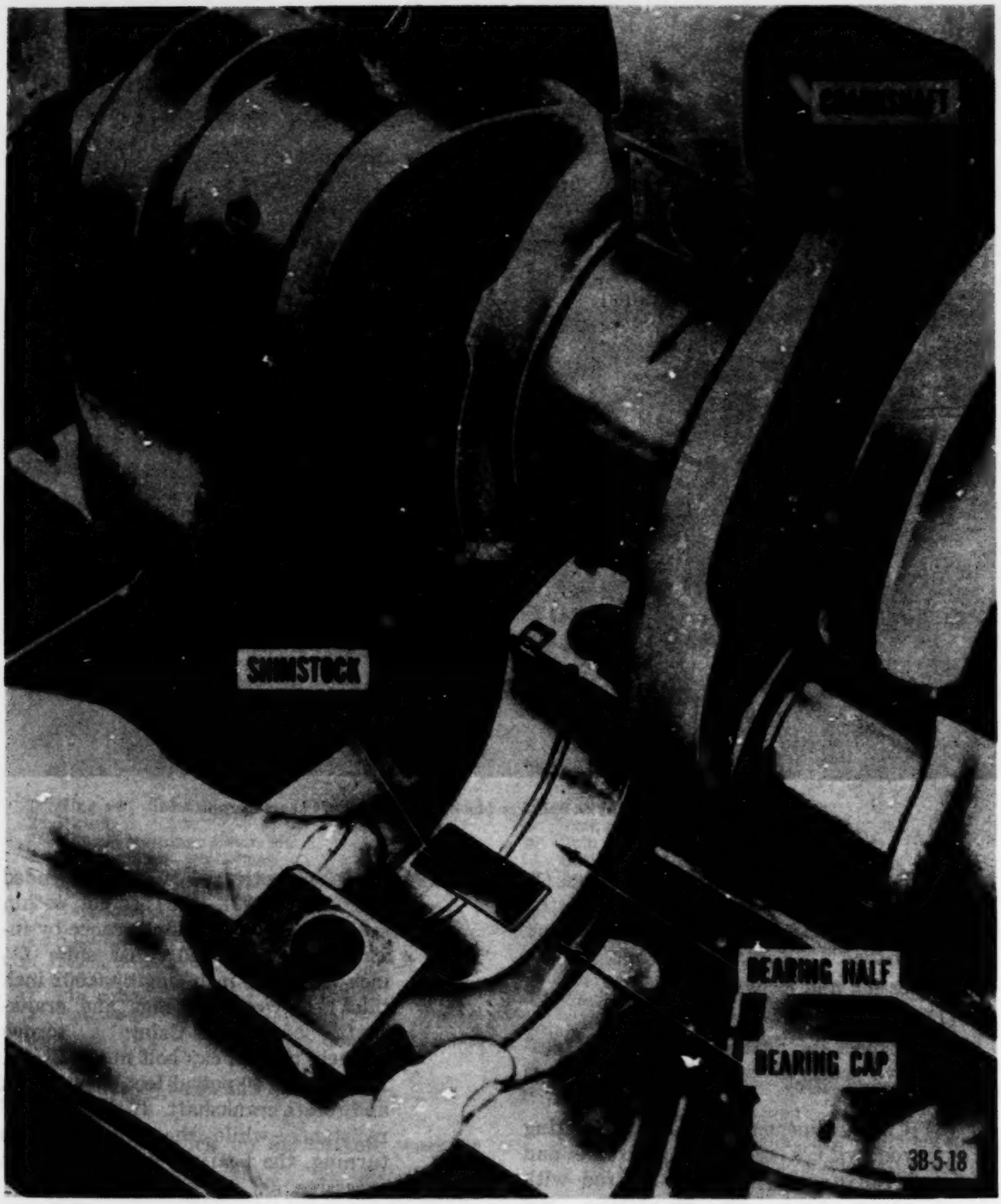
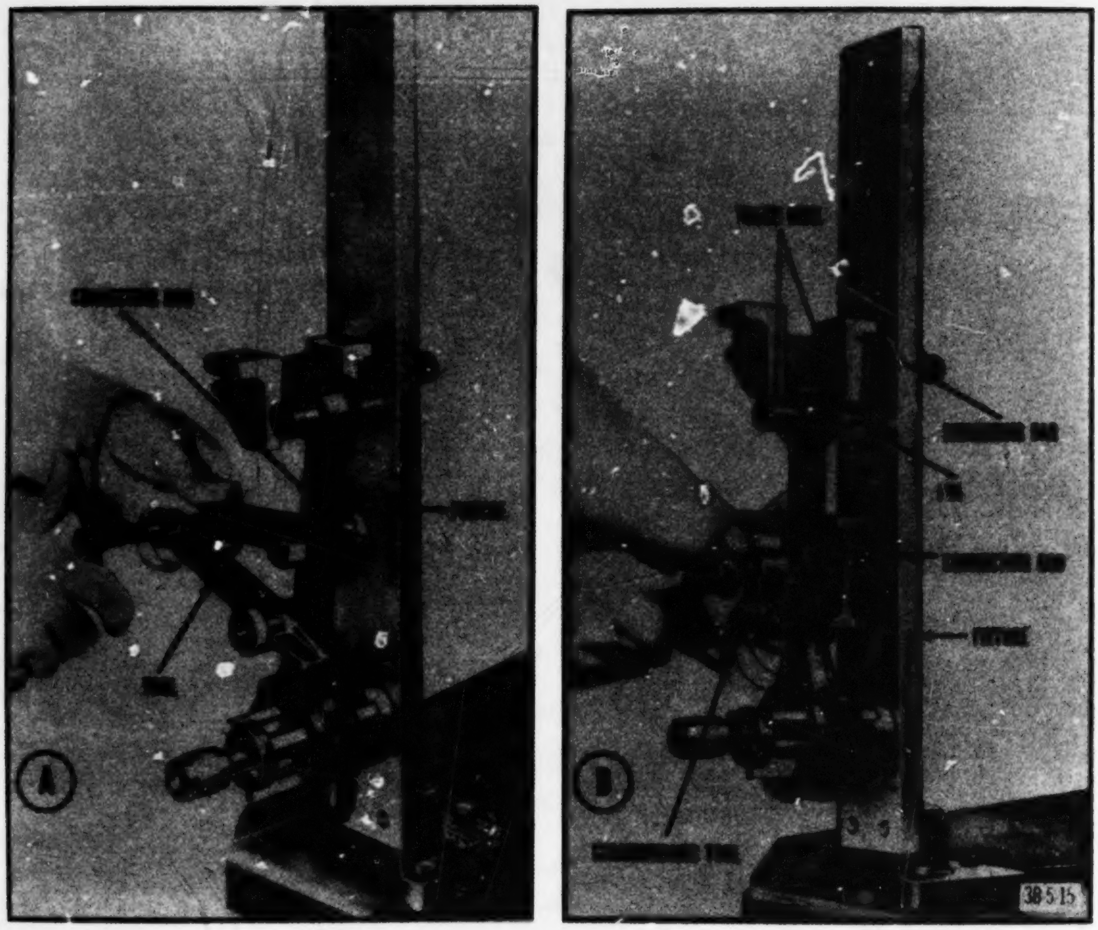

CRANKSHAFT
SHIMSTOCK
BEARING HALF
BEARING CAP
3B-5-18

Figure 12. Shimstock method of checking crankshaft bearing clearance.



A—Correcting twisted rod
B—Correcting bent rod
Figure 13. Connecting rod mounted in alining fixture.

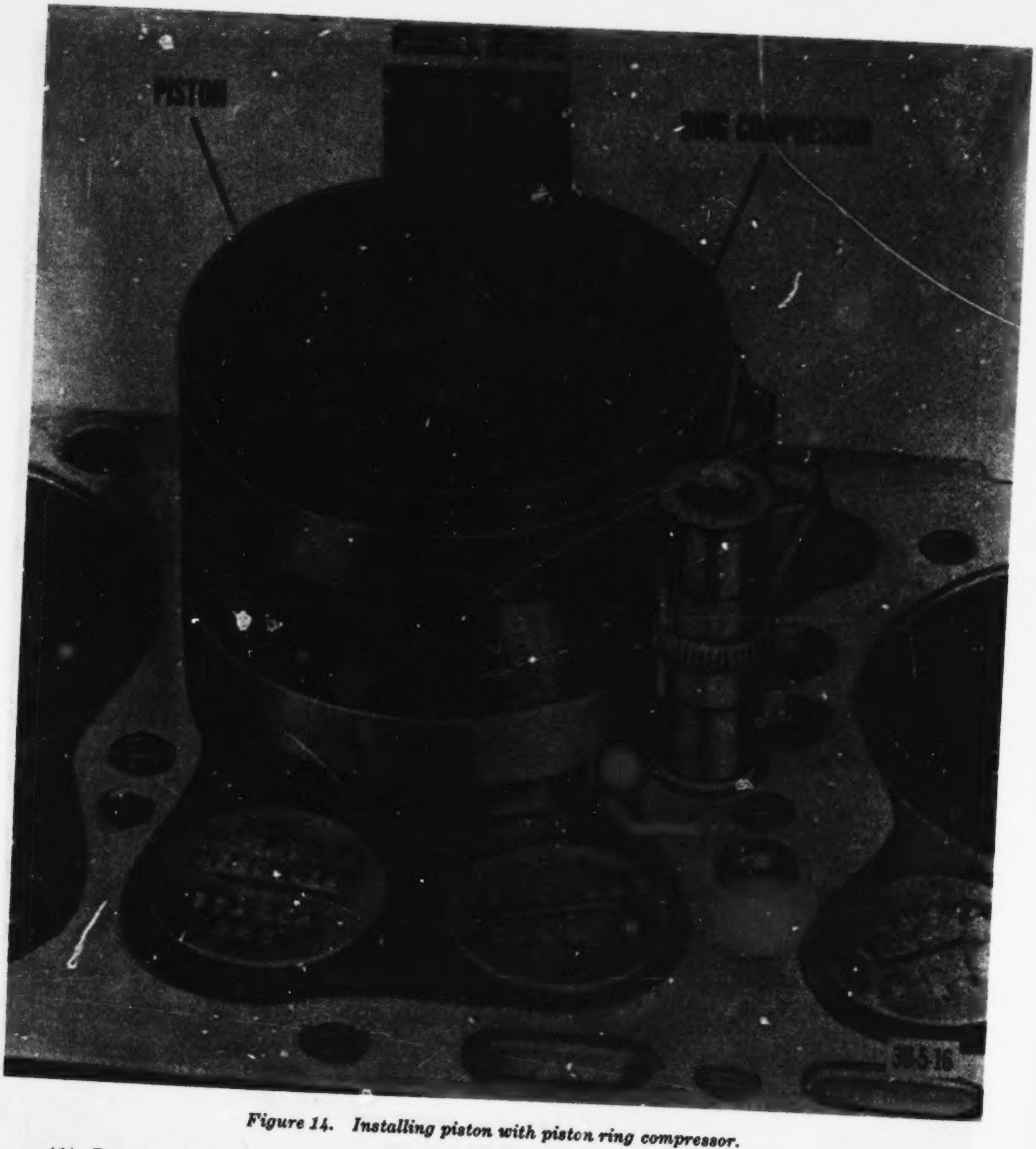


Figure 14. Installing piston with piston ring compressor.

(1) Remove carbon from piston by soaking in SD. Make certain that ring grooves are clean.

(2) Clean carbon from oil return holes in ring grooves by running a drill throug the hole.

(3) Inspect pistons for fractures at ring lands; inspect skirts and piston pin bosses. If pistons show signs of wavy ring lands or other damage, install new pistons (*f* below).

c. Fitting Piston Pins. Check fit of piston pin in connecting rod, as shown in figure 15. The piston pin should be a palm-push fit in piston at room temperature (70° F.). Do not enlarge piston pin bores unless oversize piston pins are to be installed. (Piston pins are available in 0.005 inch oversize.) Hone bearing if proper pin fit is not obtained. After assembling pin in piston, see that both retaining rings are in place.

d. Fitting Piston Rings.

(1) Install piston ring in bore of cylinder. Invert piston and use it to push ring about 2 inches from bottom of bore.

(2) Measure gap with feeler gage (fig. 16). The gap should be 0.007 inch for all rings. If the gap is less than specifications, remove ring, and file ends until proper gap is obtained.

(3) Check rings for proper side clearance (par. 7 and fig. 17) and install them in proper groove on piston.

e. Fitting Pistons.

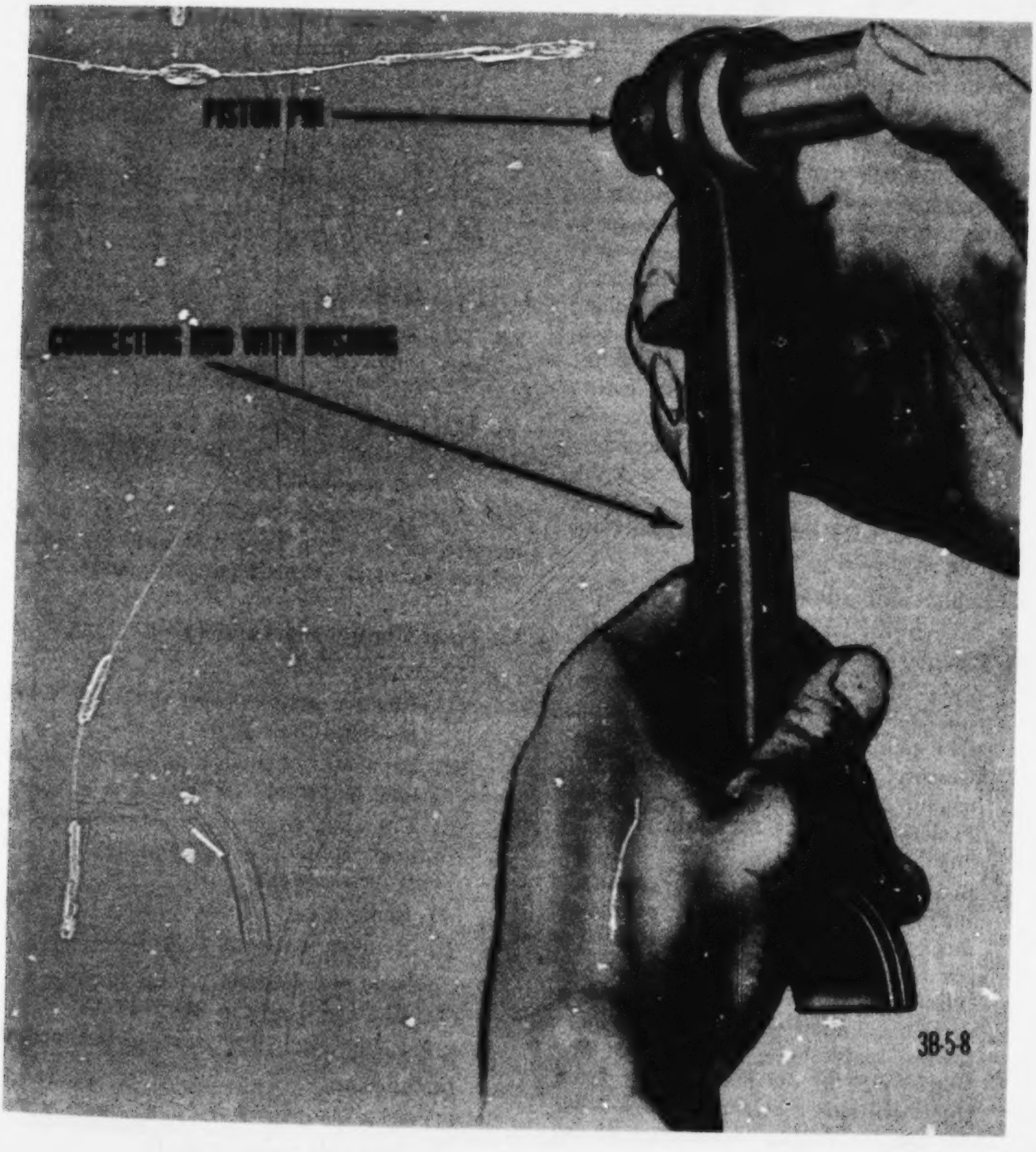


Figure 15. Fitting piston pin.

(1) Insert a ½ inch width feeler gage (0.003 inch thickness) full length in the cylinder bore.

(2) Insert piston halfway down the bore and hook scale in end of feeler gage.

(3) Pull on scale to lift feeler gage out slowly (fig. 18). If the fit is correct, scale should register pull of 5 to 10 pounds.

(4) Test bore for roundness by inserting feeler gage in several places around cylinder walls. Any variation in roundness will be noted by an increased or decreased weight on scale as feeler gage is pulled out.

(5) Measure cylinder bores carefully. If rings are good and engine is known to have definite power loss or excessive fuel consumption, and compression tests and careful examination eliminate valves as the source of trouble, reboring of cylinders for oversized pistons may be necessary (fifth echelon only). As a general rule, cylinders will be rebored if if taper exceeds 0.007 inch. If taper is not excessive, the use of new rings may correct the trouble. When selecting new pistons, check diameter carefully with micrometer as shown in figure 19.

f. Assembly and Installation.

(1) Oil cylinder wall and flood piston with OE.

(2) Make sure that ring gaps are spaced equally about circumference of piston; then compress rings with ring compressor. Tap compressor lightly around circumference as compressor is closed on rings to allow rings to close evenly.

(3) Because connecting rods are offset and must be installed in proper bore, check number stamped on connecting rod with corresponding number on cylinder bore. Install piston rod in proper cylinder with oil squirt hole toward valve side of engine (the slotted side of the piston away from the valve side). Crankshaft journal for the connecting rod should be installed at bottom dead center.

(4) Use handle end of hammer to force piston through compressor and into cylinder (fig. 14). To prevent damage to piston rings, always keep compressor tight against block while forcing piston into cylinder.

(5) Place upper half of connecting rod bearing in rod, making certain that small forward ear fits in the machined grooves in the rods.

(6) Oil crankshaft journal with OE, and install lower half of connecting rod bearing in cap, and install cap in connecting rod. Tighten rod nuts to 35 to 40 foot-pounds torque.

(7) Install cylinder head (TM 10-3930-222-20).

(8) Install oil pan (par. 14*c*).

31. Cylinder Block

a. Inspection. With engine out and all assemblies removed, inspect the cylinder block for:

(1) Cracks, breaks, and leaks.

(2) Inspect bore for scoring, wear, and out-of-round.

b. Overhaul. If bore is out-of-round and inspection shows much wear, it will be necessary to have the block rebored (fifth echelon).

32. Heat Control Shaft and Valve

a. Removal.

(1) Remove heat control assembly (TM 10-3930-2220-20).

(2) Separate exhaust manifold from intake manifold.

(3) Cut spot welds that attach valve to heat control shaft and slide shaft from manifold.

(4) Remove valve from exhaust manifold.

(5) Remove bushings from manifold.

b. Cleaning and Repair.

(1) Wash all parts in SD.

(2) Replace defective parts as authorized.

c. Installation.

(1) Reverse procedures in *a* above.

(2) Spotweld valve to shaft.

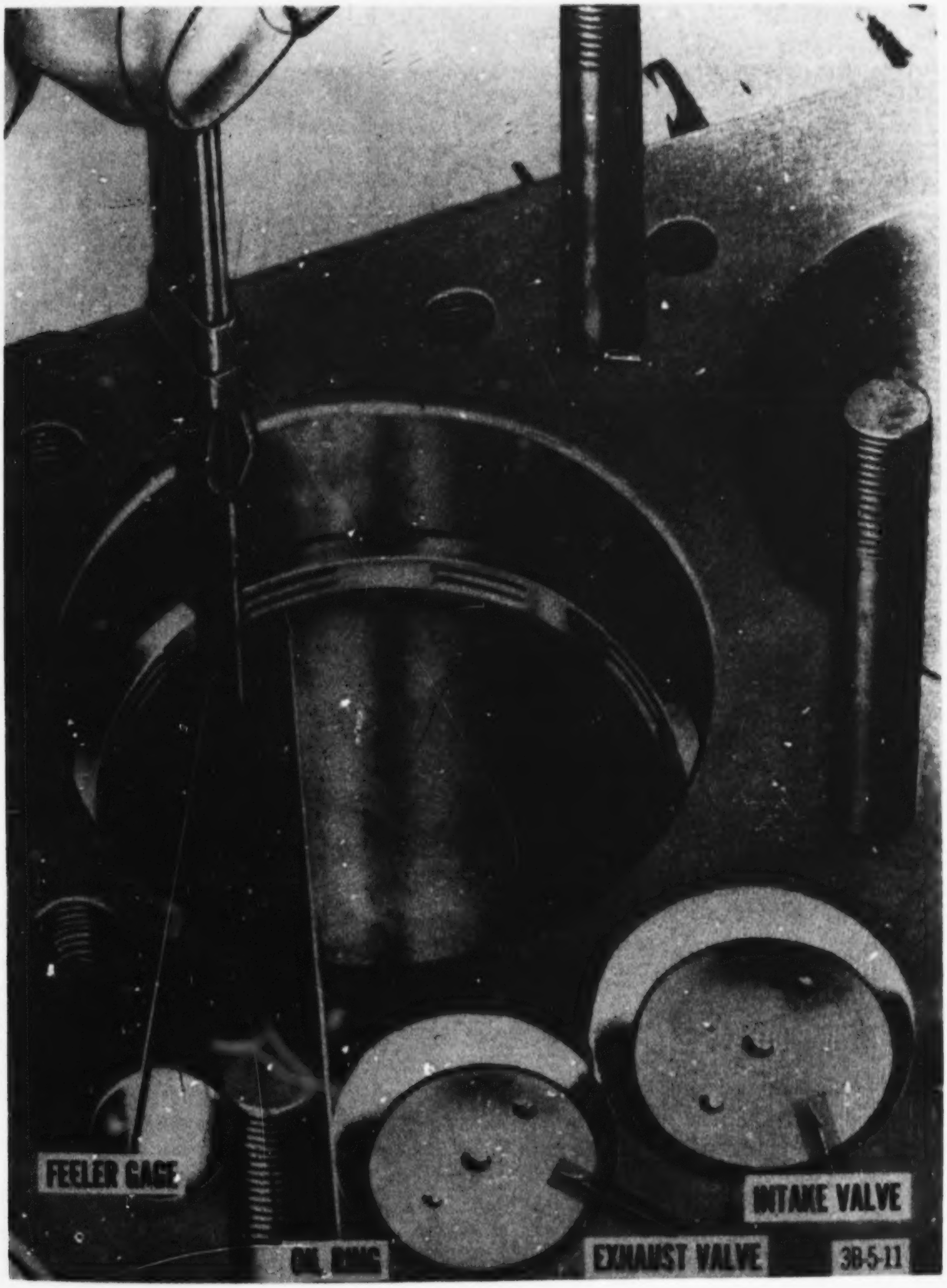

FEELER GAGE
OIL RING
EXHAUST VALVE
INTAKE VALVE
3B-5-11

Figure 16. Measuring ring gap.

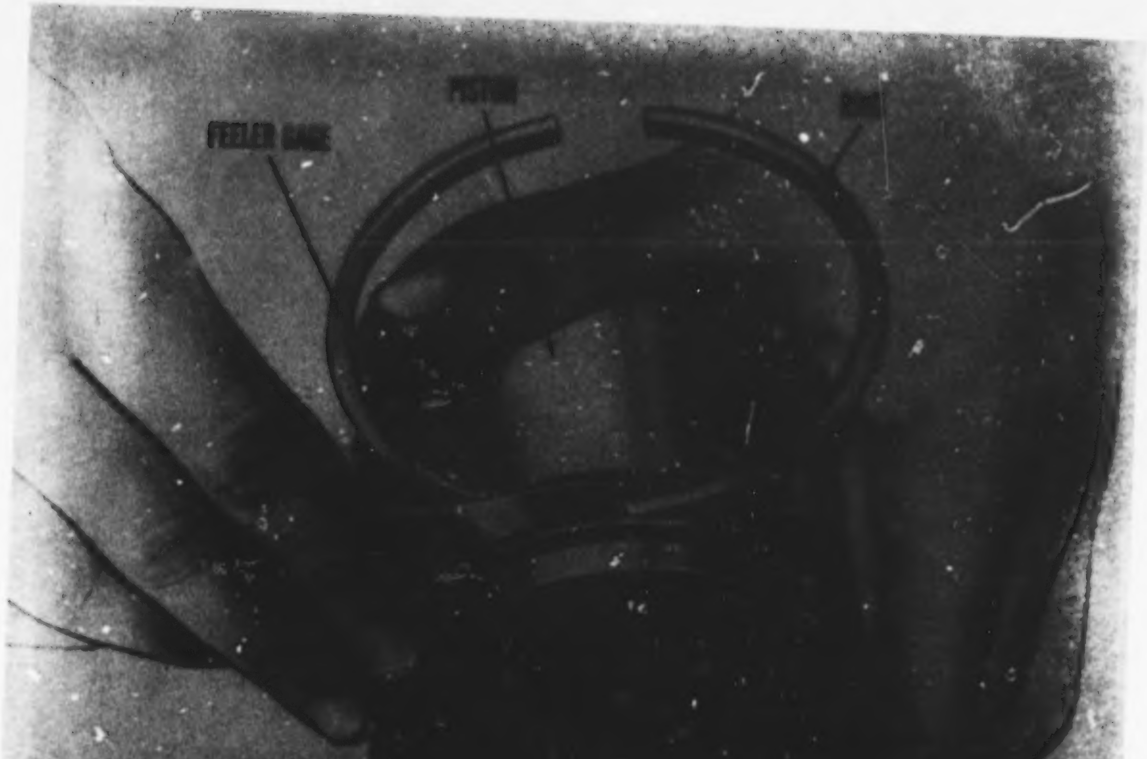

FEELER GAGE
PISTON

Figure 17. Checking piston ring side clearance.

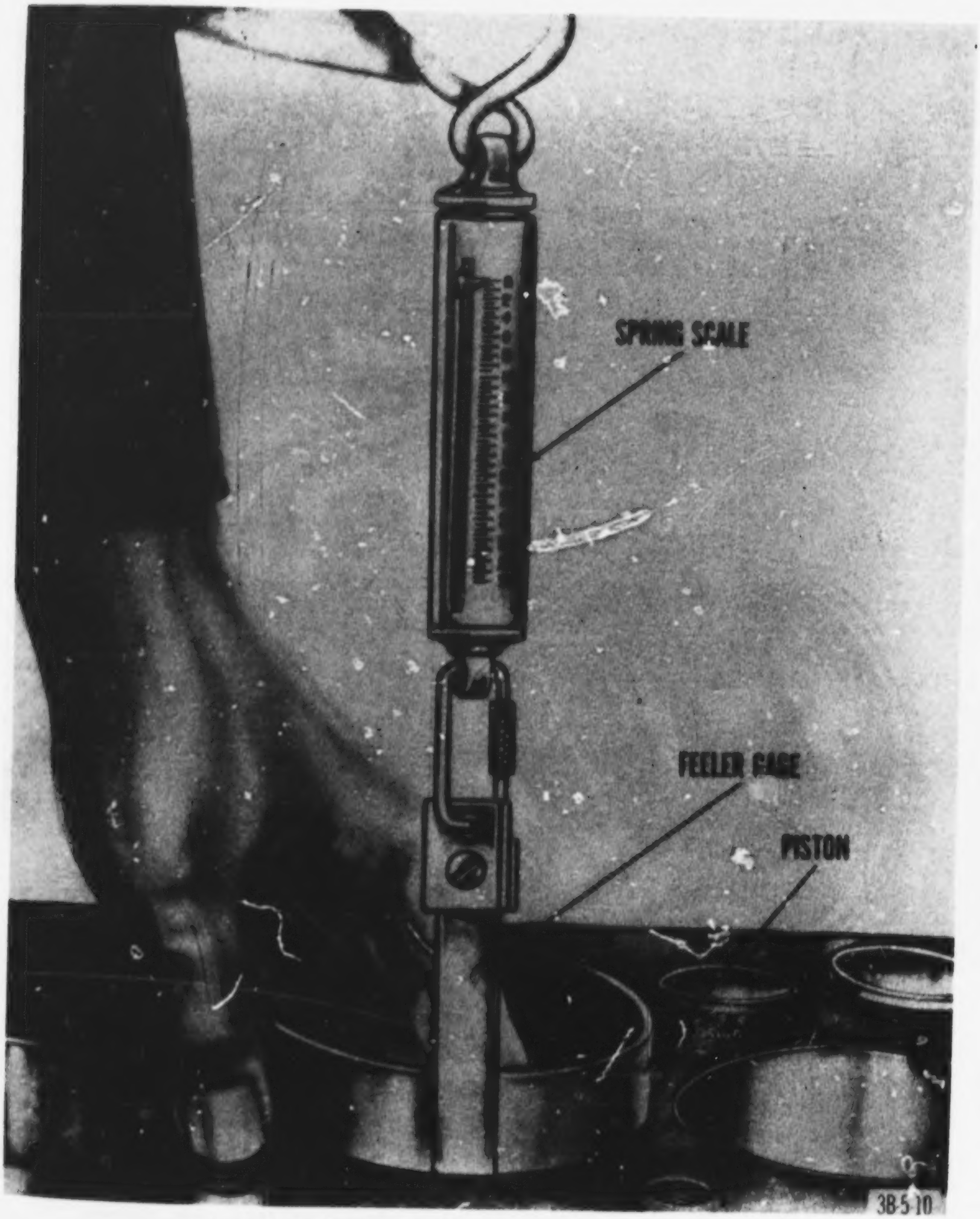

SPRING SCALE
FEELER GAGE
PISTON
3B-5-10

Figure 18. Fitting piston to cylinder bore.

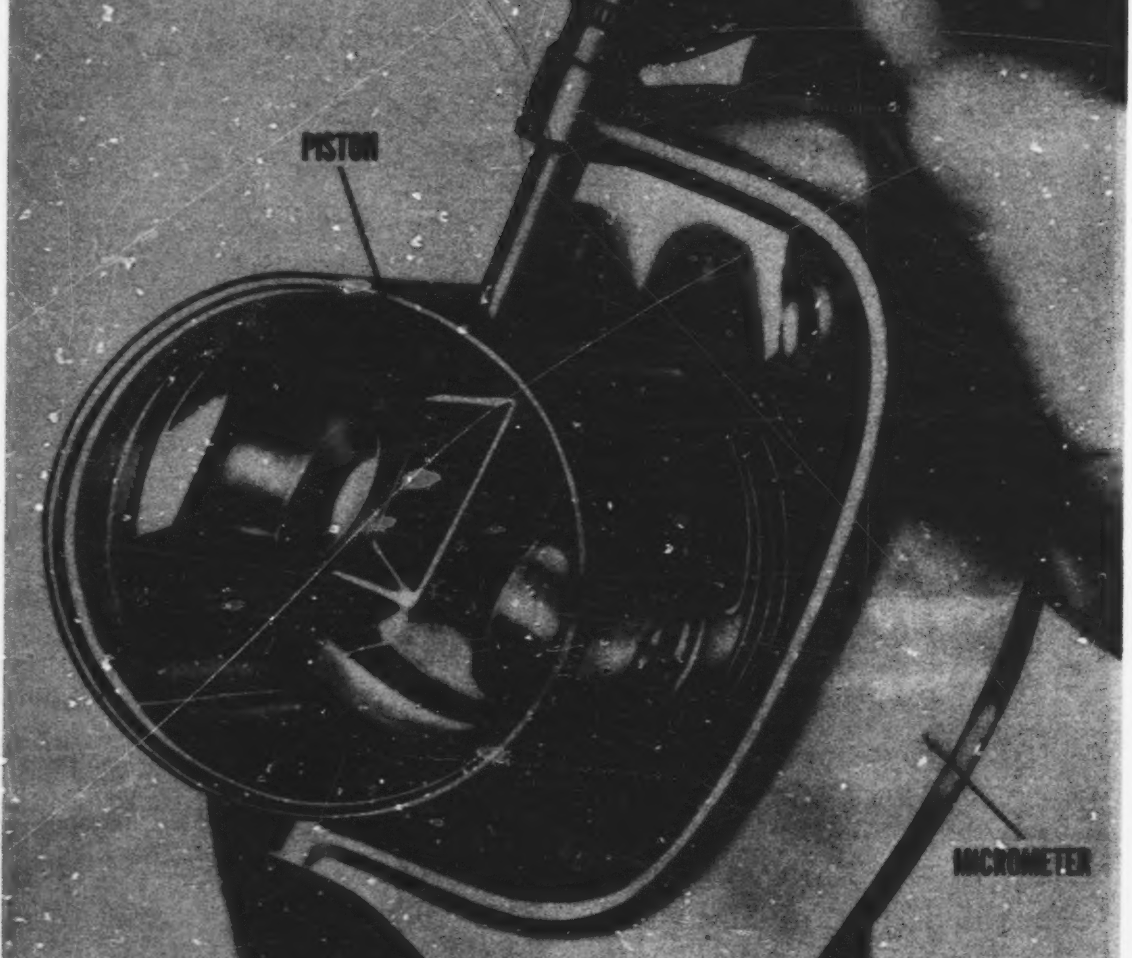

PISTON
MICROMETER
3859

Figure 19. Measuring piston.

Section IV. FUEL SYSTEM (GROUP 03) AND COOLING SYSTEM (GROUP 05)

33. Carburetor

a. Removal. Refer to TM 10-3930-222-20.

b. Disassembly.

(1) Unscrew and remove filter head (1, fig. 20) and element filter (3).

(2) Remove filter head washer (2) from filter head.

(3) Unscrew and remove screws (34) and lockwashers that secure air intake (30) to fuel bowl (23) of carburetor and remove air intake and gasket (3).

(4) Pull float axle (27) from air intake and remove float (7).

(5) Remove valve (6) from valve seat (5). Unscrew valve seat from air intake and remove washer (4).

(6) Unscrew and remove vacuum cylinder (28) and washer (29) from air intake.

(7) Remove screw (35) that secures choke plate (36) to choke lever and shaft (31) and slide shaft out of air intake and remove choke plate.

(8) Remove screws (24) and lockwashers that secure fuel bowl (23) to throttle body (16) and separate fuel bowl and throttle body and gasket (21).

(9) Unscrew and remove main jet (10) and washer (11) from bottom of fuel bowl (23).

(10) Unscrew and remove power jet valve (9) from fuel bowl.

(11) Remove discharge jet passage plug (14) and washer (13) from bottom of fuel bowl.

(12) Remove main discharge jet (12) from fuel bowl.

(13) Remove venturi (22) from fuel bowl.

(14) Remove well vent jet (25) from fuel bowl.

(15) Remove idling jet (26) from fuel bowl.

(16) Remove idle adjusting needle (17) and spring from throttle body (16).

(17) Unscrew screws (20) that secure throttle plate (15) to throttle shaft and lever (19) and remove plate and shaft from carburetor.

c. Cleaning.

(1) Clean all parts in SD and dry them thoroughly with either compressed air or a clean, lint-free cloth.

(2) Clean all small passages and orifices with a clean, soft wire or some other item suitable for probing. Be careful not to mark machined surfaces.

d. Inspection and Repair.

(1) Inspect the float for cracks, dents, holes, or breaks.

(2) Inspect the float shaft for bends or worn bearing surfaces.

(3) Inspect both the valve seat and the valve for wear, scratches, and nicks.

(4) Inspect the idle adjusting needle for ridges and other damages.

(5) Inspect the throttle disk for cracks, nicks, and burs. Remove the nicks and burs, if possible.

(6) Inspect the choke disk for bends, cracks, and burred edges.

(7) Inspect the shafts and other parts for wear, distortion, rust, and other defects.

(8) Replace all gaskets each time the carburetor is disassembled.

(9) Replace other items as authorized.

e. Assembly.

(1) Reverse procedure in *b* above.

(2) The float setting should be 1½ inches plus or minus 1/32 inch from milled face of throttle body to bottom of float.

f. Installation. Refer to TM 10-3930-222-20.

34. Governor

a. Removal. Refer to TM 10-3930-222-20.

b. Disassembly.

(1) Remove screw (27, fig. 21) and separate body (7) and lever assembly (13) from gear and shaft base assembly (26).

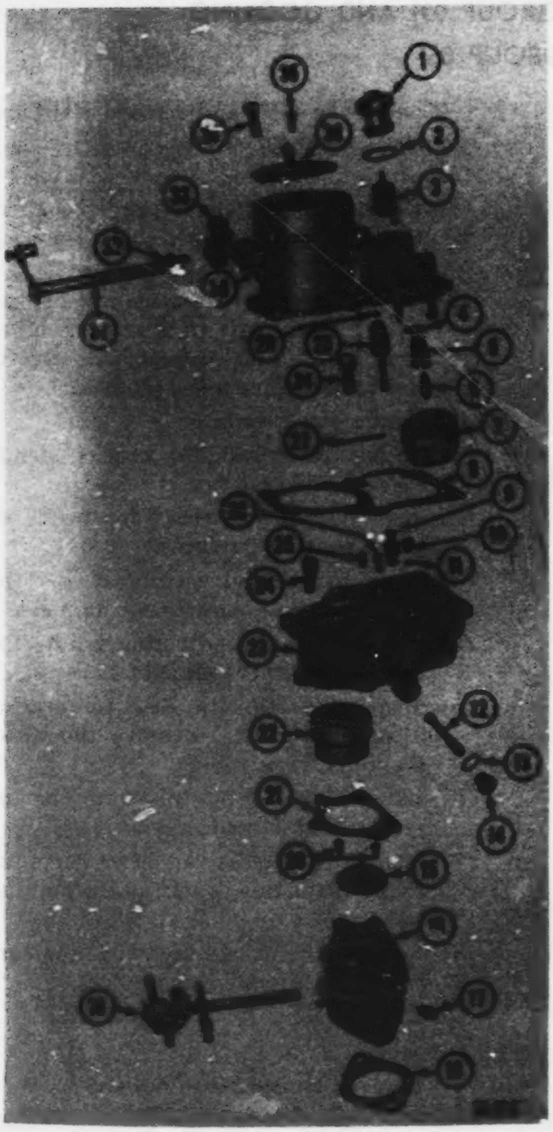


Figure 20. Carburetor, exploded view.

(2) Remove clip (19) from end of gear and shaft base assembly and remove two washers (20 and 21), fork base (22), thrust bearing (23), upper race (24), and four balls (25) from drive shaft.

(3) Loosen locknut (6) on adjusting screw (5). Unscrew adjusting screw and remove from body.

(4) Remove pipe plug (37) from governor body to gain access to fork pin (30) and remove fork pin from lever shaft (13).

(5) Slide lever assembly (13) from body (7). As lever is removed from body, fork (31) and bumper springs (32) will fall from body.

(6) Separate fork and bumper spring.

(7) Drive expansion plug (36) from body and remove bearing (35).

(8) Remove bearing sleeve (8) and oil seal (9) from body.

(9) Remove drive shaft bushing (33) from body.

(10) Remove drive shaft thrust plate (34) from body.

c. Cleaning. Clean all parts in SD and wipe dry with clean cloth.

d. Inspection and Repair.

(1) Inspect all parts for wear or damage.

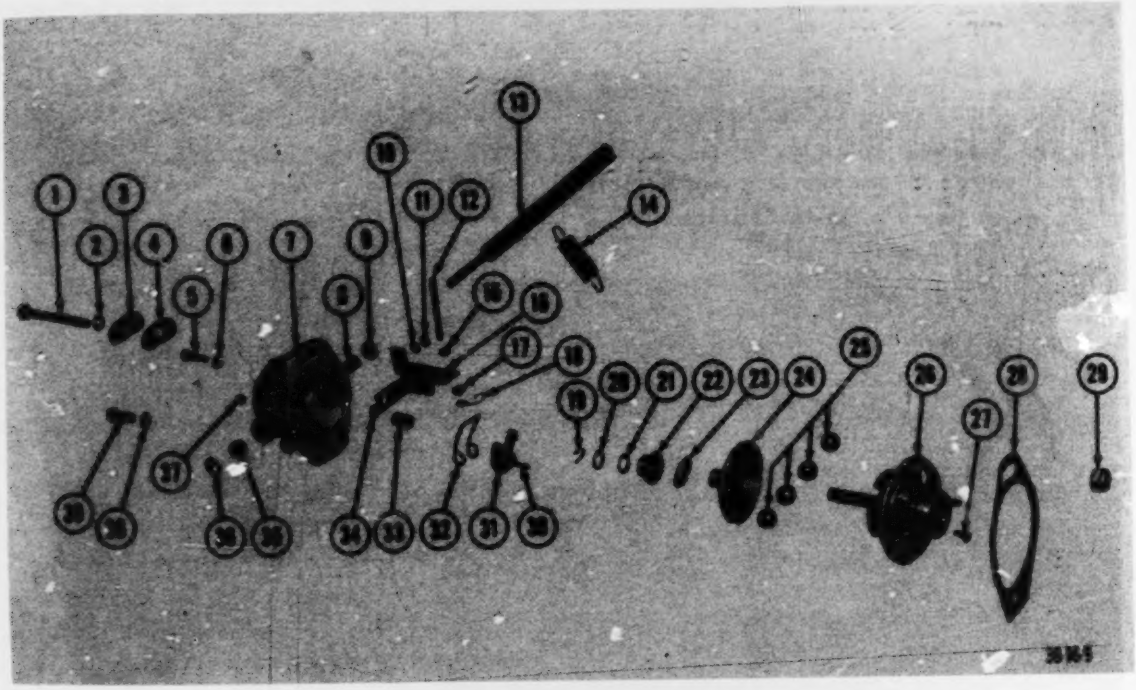
(2) Replace defective parts as authorized.

e. Assembly. Reverse procedures in *b* above.

f. Installation and Adjustment. Refer to TM 10-3930-222-20.

1	**Head, filter**
2	**Washer, filter head**
3	**Filter, element**
4	**Washer, valve seat**
5	**Seat, valve**
6	**Valve**
7	**Float**
8	**Gasket**
9	**Valve, power jet**
10	**Jet, main**
11	**Washer, nonmetallic**
12	**Jet, main discharge**
13	**Washer, passage plug**
14	**Plug, discharge jet passage**
15	**Plate, throttle**
16	**Body, throttle**
17	**Needle, idle adjusting**
18	**Gasket, flange**
19	**Lever and shaft, throttle**
20	**Screws, throttle plate**
21	**Gasket, bowl-to-body**
22	**Venturi**
23	**Bowl, fuel**
24	**Screw, bowl-to-body**
25	**Jet, well vent**
26	**Jet, idle**
27	**Axle, float**
28	**Cylinder, vacuum**
29	**Washer, vacuum cylinder**
30	**Intake, air**
31	**Lever and shaft, choke**
32	**Screw, bracket assembly**
33	**Bracket, choke**
34	**Screw, intake**
35	**Screw, choke plate**
36	**Plate, choke**

***Figure 20*—Continued.**



1	Screw
2	Washer, flat
3	Plate, governor gasket
4	Gasket
5	Bolt, internally relieved (adjusting)
6	Nut, locking
7	Body assembly
8	Bearing, roller needle
9	Seal, oil
10	Lockwasher
11	Nut
12	Stud
13	Lever assembly
14	Spring
15	Nut
16	Anchor, spring
17	Nut, drilled
18	Wire, seal
19	Clip
20	Washer
21	Washer
22	Base, fork
23	Bearing, thrust
24	Race, upper
25	Balls
26	Base assembly, gear and shaft
27	Screw
28	Gasket
29	Nut
30	Pin, fork
31	Fork
32	Spring, bumper
33	Bushing, drive shaft
34	Plate, thrust
35	Bearing, sleeve, lever shaft
36	Plug, expansion
37	Plug, pipe
38	Lockwasher
39	Screw, mounting

Figure 21. Governor, exploded view.

35. Radiator

a. Removal.

(1) Open drain cock (8, fig. 22) and drain radiator (7).

(2) Remove headlight wire from clamps on radiator.

(3) Remove hood (TM 10–3930–222–20).

(4) Remove fan (TM 10–3930–222–20).

(5) Loosen hose clamps (5 and 11) and disconnect radiator hoses (4 and 12).

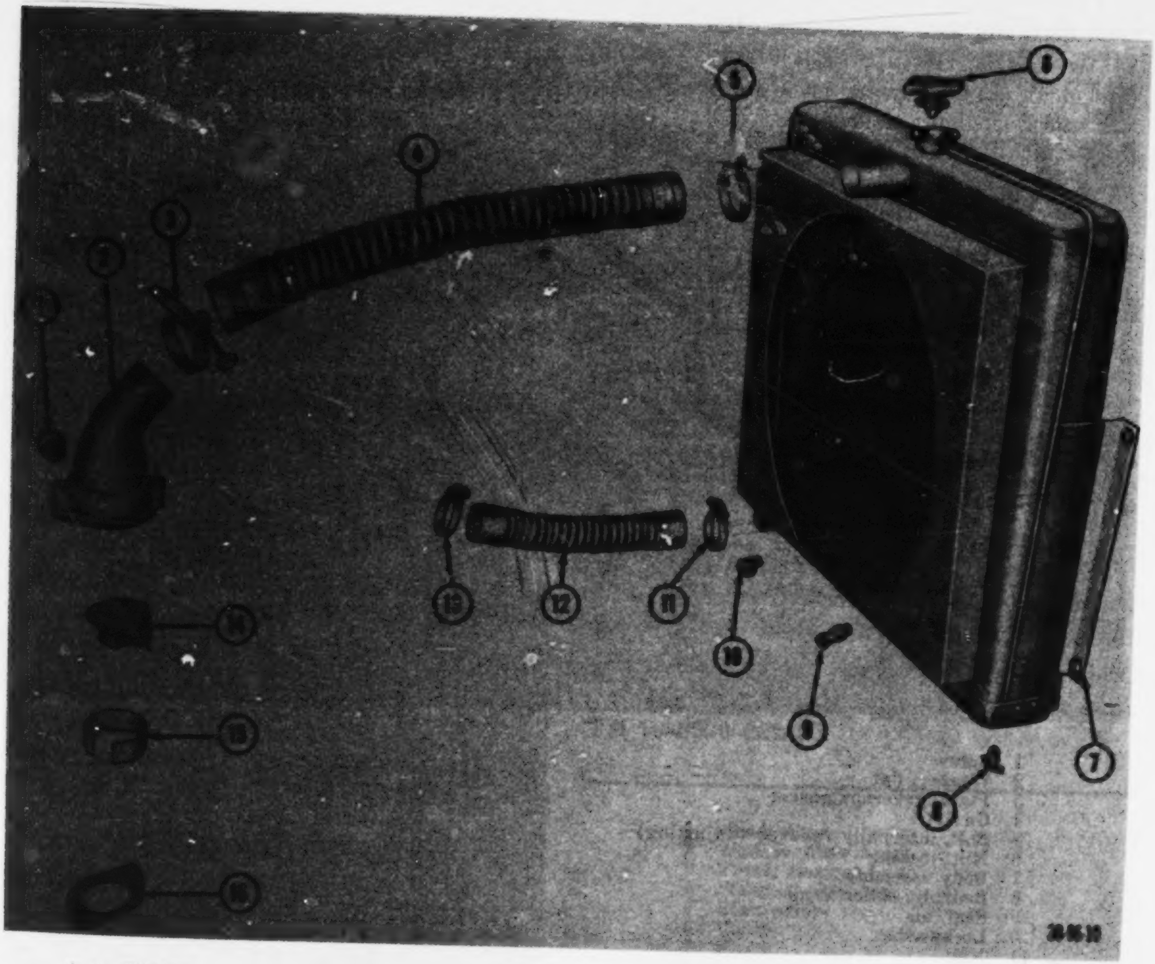
(6) Remove screws, washers, and lockwashers that secure the radiator to the truck.

(7) Disconnect two transmission oil hoses at radiator.

(8) Remove radiator (7) from truck, being careful not to damage core.

b. Cleaning, Testing, and Repair. Refer to TM 10–3930–222–20 for cleaning instructions. Refer to TM 10–450. Test and repair the radiator as needed.

c. Installation. Reverse procedures in *a* above being careful not to damage the core.



1	Fitting
2	Elbow, cylinder head water outlet
3	Clamp, hose
4	Hose, radiator upper
5	Clamp, hose
6	Cap
7	Radiator
8	Cock, drain
9	Nipple, hose
10	Elbow, strut
11	Clamp, hose
12	Hose, radiator lower
13	Clamp, hose
14	Thermostat
15	Ring, thermo adapter
16	Gasket

Figure 22. Radiator and attaching parts.

Section V. ELECTRICAL SYSTEM (GROUP 06)

36. Starting Motor

a. Removal. Refer to TM 10–3930–222–20.

b. Disassembly.

(1) Remove screw (16, fig. 23) and lockwasher (15) that connects the solenoid switch (12) to the field terminal on the starting motor housing (28).

(2) Remove screws (14 and 17) and lockwashers (13 and 27) that secure solenoid relay (12) to drive housing (38) and remove switch.

(3) Remove plunger return spring (11), from plunger (10).

(4) Remove two bolts (21) that connect commutator end frame (20) and drive housing (38) to housing (28).

(5) Remove commutator end frame from housing.

(6) Remove washer (22) from shaft of armature (29).

(7) Pull drive housing with armature from housing.

(8) Unscrew brush holder screws (18) and remove brushes (19).

(9) Remove brush holder pivot pins (24) and spring (25) from housing.

(10) Remove screws (9 and 30) lockwashers (8 and 31) that secure sleeve bearing (7) to drive housing (38).

(11) Remove lever nut (36) and remove bolt (1) from housing.

(12) Remove drive assembly lever (5) with plunger (10) from housing.

(13) Remove pin (6) that connects drive lever and plunger and separate plunger from lever.

(14) Remove thrust collar (3) from drive end of armature shaft.

(15) Remove retainer ring (34) that secures pinion stop collar (4) to armature shaft and remove stop collar.

(16) Slide drive assembly (33) from shaft.

(17) Remove sleeve bearing (39) from drive housing (38).

c. Cleaning and Inspection.

(1) Using air hose or clean cloths, remove dirt and grease before proceeding with inspection of parts.

Caution: **Do not wash armature, field coils, or drive assembly in SD.**

(2) Make the following tests:

(*a*) *Brushes.* If brushes are worn to less than ½ their original length, replace brushes.

(*b*) *Armature.*

1. If the commutator is worn, dirty, or out-of-round, turn the commutator in a lathe. Sand the commutator lightly with No. 00 sandpaper to remove any burs.

2. Check all wiring and connections. Use rosin flux on any soldered connections that are made.

3. Check armature for short circuits by the use of a growler. Revolve armature in a growler with a steel strip such as a hacksaw blade held over the core parallel to the shaft. The blade will vibrate above the short circuit if one is present. If an external examination discloses nothing to cause a short circuit, such as foreign material between the bars of the commutator, install a new starting motor.

4. Check armature for grounding by placing one test prod on the end of the commutator and the other test prod on the laminated core or shaft. If the test lamp lights, a ground is present and the starting motor should be replaced.

(*c*) *Field coils.* Using 110- volt test lamp, check for grounds between field coils and housing. Place one test prod on housing and one test prod on field lead. If circuit is grounded, light will light. Then replace starting motor.

(*d*) *Drive assembly.* Check to see that over-running clutch does not slip in forward motion. Check for broken spring and worn or burned drive gear. If defects are found, replace drive assembly.

d. Assembly. Reverse procedures in *b* above. Coat splines of drive assembly with OE oil.

e. Installation. Refer to TM 10-3930-222-20.

37. Generator

a. Removal and Installation. Refer to TM 10-3930-222-20.

b. Disassembly.

(1) Unscrew and remove bolts (26, fig. 24) that secure commutator end frame (24) and drive end frame (7) to housing (15).

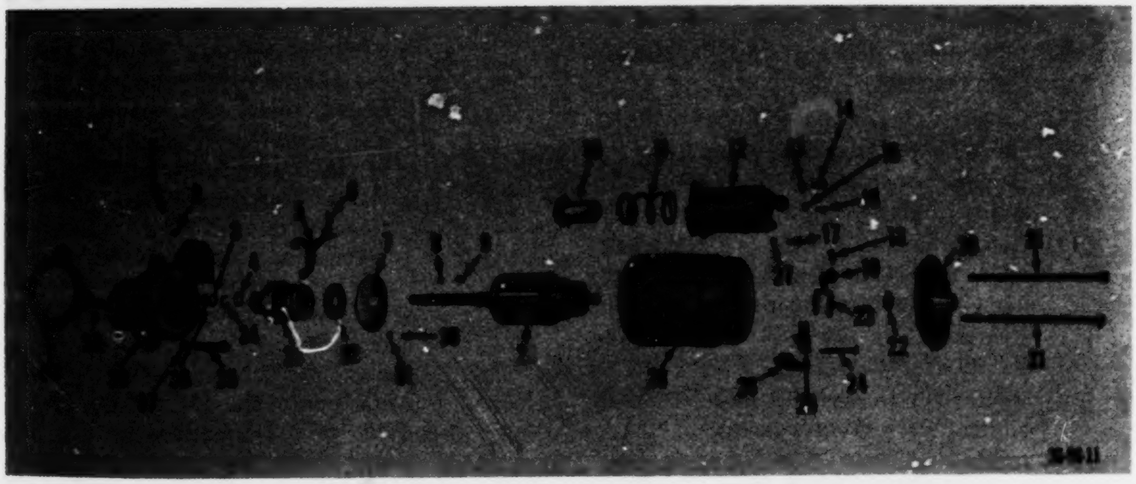
(2) Separate commutator end frame (24) from housing.

(3) Remove drive end frame (7) with armature (14) from housing.

(4) Remove screws (21 and 27) and washers (20 and 28) from brush holders and remove brushes (22).

(5) Remove brush holder springs from brush holders.

(6) Pull armature (14) from drive end frame and bearing (10).



1	Bolt, shoulder, drive lever
2	Washer
3	Collar, thrust
4	Collar, pinion stop
5	Lever, assembly, drive
6	Pin, spring, lever-to-plunger
7	Bearing, sleeve, center
8	Lockwasher
9	Screw
10	Plunger
11	Spring, compression, plunger return
12	Relay, solenoid, starter
13	Lockwasher
14	Screw
15	Washer
16	Screw
17	Screw
18	Screw, brush attaching
19	Brush, contact
20	Frame, commutator end
21	Bolts
22	Washer, brake, commutator end
23	Holder, brush, ground
24	Pin
25	Spring, brush
26	Holder, brush, insulated
27	Lockwasher
28	Housing
29	Armature
30	Screw
31	Lockwasher
32	Washer
33	Drive assembly
34	Ring, retainer
35	Capscrew
36	Nut
37	Lockwasher
38	Housing, drive
39	Bearing, sleeve, drive end
40	Adapter, starting motor

Figure 23. Starting motor, exploded view.

(7) Remove screws (36) and washers (37) that attach bearing plate (12) to drive end frame and remove plate.

(8) Remove gasket (11), bearing (10), felt retaining plate (9) and washer (8) from drive end frame (7).

c. Cleaning. Using air hose or clean cloths, remove all dirt from component parts of generator before inspecting them.

d. Inspection, Testing, and Repair.

(1) *Frame, field coils, brushes, springs, leads, connections, and terminal stud.*

(*a*) Inspect field coils for worn or frayed insulation; corroded, loose, or burned terminal stud assembly; and loose or corroded connections.

(*b*) Inspect brushes for excessive wear, broken or frayed leads, and oil saturation. Replace brushes if worn beyond one-half original length.

(*e*) Be certain that brush holders are not bent or damaged in any manner and that brush springs are not corroded or distorted. Check for brush spring tension of 28 ounces.

(*d*) Using a testing device consisting of a lamp wired in series with two probes and the source of electricity, inspect the field coils for proper ground. Before testing, be sure brushes are not touching frame or pole shoes, then proceed as follows: Touch one probe to terminal stud and the other probe to an unpainted spot on the frame. Should the lamp light, the current in the field coils is being grounded before it completes its circuit. If the field coils are defective, replace generator.

(*e*) Repair or replace defective items as authorized.

(2) *Armature.*

(*a*) Be certain that all coils are pressed into core slots and soldered to commutator risers.

(*b*) Inspect core for deep nicks and cuts.

(*c*) Inspect commutator for rough surface or other indications of wear.

(*d*) Inspect shaft bushing seats for wear.

(*e*) Inspect and test each commutator segment for ground. Use testing device (*d*(1)(*d*) above) and proceed as follows: Place the armature on a V-block, and touch one test probe to either the core or the shaft of the armature and the other probe to each commutator segment. If a commutator segment is grounded, the lamp will light. Using a dry brush, a cloth, or compressed air, clean between the metal strips on the commutator; then retest it. If the segment is still grounded, the armature is unserviceable.

(*f*) Check armature for grounding by placing one test prod on the end of the commutator and the other test prod on the laminated core or shaft. If the test lamp lights, a ground is present and the armature should be replaced.

(*g*) Check armature for short circuits by the use of a growler. Revolve armature in a growler with a steel strip such as a hacksaw blade held over the core and parallel to the shaft. The blade will vibrate above the short circuit if one is present. If an external examination discloses nothing to cause a short circuit, such as foreign material between the bars of the commutator, the armature is unserviceable.

(*h*) To test for out-of-round, place the armature with the shaft on V-blocks and mount the dial indicator so that its plunger rests against the commutator. Rotate the armature slowly, and note the variations in thousandths shown on the face of the dial indicator. The variation is the extent to which the armature is out-of-round and is referred to as runout. If the commutator is more than 0.003 inch out-of-round, place the armature in a lathe and machine it to proper specifications. Remove all burs with No. 00 sandpaper; then undercut the mica.

(*i*) Inspect drive end bearing for roughness.

(*j*) Repair defective items as authorized or replace generator.

e. Assembly. Reverse procedures in *b* above.

1	Nut, shaft
2	Lockwasher
3	Pulley
4	Fan
5	Capscrew
6	Plate, generator adjusting
7	Frame, drive end
8	Washer, felt
9	Plate, felt retaining
10	Bearing, ball
11	Gasket
12	Plate, bearing retainer
13	Washer, space
14	Armature
15	Housing
16	Lockwasher
17	Nut
18	Lockwasher
19	Nut
20	Lockwasher
21	Screw
22	Brush, electrical contact
23	Spring, brush
24	Frame, commutator end
25	Lockwashers
26	Bolts
27	Screw
28	Lockwasher
29	Nut
30	Nut
31	Bracket, generator
32	Nut
33	Nut
34	Bolt
35	Key
36	Screw
37	Washer
38	Collar, space
39	Lockwasher

Figure 24. Generator, exploded view.

Section VI. TRANSMISSION

38. Transmission

a. Removal.

(1) Drain transmission.

(2) Disconnect drive shaft (par. 45).

(3) Disconnect transmission linkage at control valve (TM 10-3930-222-20).

(4) Disconnect inching pedal linkage (TM 10-3930-222-20).

(5) Disconnect temperature warning transmitter (fig. 25).

(6) Disconnect neutral switch connection (fig. 25).

(7) Disconnect hydraulic hose at the elbow on the rear housing cover (fig. 25).

(8) Remove wiring harness.

(9) Remove the retaining nut from the bottom of the taper pin (fig. 25).

(10) Fabricate a spacer. Using the fabricated spacer and the nut removed

from the taper pin, remove the taper pin from the transmission case top cover (fig. 26).

(11) Remove capscrews that secure rear housing cover bearing cap to transmission and remove housing cover and gasket.

(12) Remove capscrews and lockwashers that secure transmission case top cover (fig. 26) to transmission. Remove the capscrews and lockwashers that secure the top cover to the torque converter housing and remove top cover.

(13) Remove the clutch pack-to-drive plate attaching bolts (fig. 27).

Note. The attaching bolts are not counter sunk. Do not remove the counter sunk bolts as the clutch pack will come apart.

(14) Fabricate a special tool (fig. 28) from $\frac{5}{16}$-inch round stock, lift the forward-and-reverse clutch pack up and to the front, and remove the pack from the transmission.

(15) Disconnect transmission-to-torque converter oil hose (fig. 29).

(16) Attach hoisting chain to transmission.

(17) Remove capscrews and lockwashers that secure the lower part of the transmission to the torque converter and remove the transmission from the truck.

b. Disassembly.

(1) Remove capscrews and lockwashers that secure front retainer (fig. 30) to transmission front cover and remove retainer and shim.

(2) Remove preformed packing (fig. 31) and oil seal (fig. 30) from retainer (19, fig. 32).

(3) Remove capscrews and lockwashers that secure transmission front cover (fig. 30) to transmission housing and remove cover with bearing (fig. 33) and ring gear assembly from housing.

(4) Remove planetary carriage assembly from transmission housing (fig. 34).

(5) Remove capscrews and lockwashers that secure bearing cap to rear cover and remove bearing cap (fig. 35).

(6) Remove capscrews and lockwashers that secure rear cover to transmission housing (fig. 35).

(7) Place a bar through the center of the high and low clutch pack (fig. 36) to carry the weight; then slide the rear cover and the high and low clutch pack back and away from the anchor assembly until all parts are clear of the transmsision housing.

(8) Remove place bolts that secure reaction anchor to lower transmission case (fig. 37) and remove anchor.

(9) Remove capscrew (8, fig. 38) and lockwasher (9) that secure keeper (10) to transmission case and remove keeper.

(10) Remove capscrew (12) and lockwasher (13) that secure keeper (14) to transmission case and remove keeper.

(11) Withdraw main idler gear shaft (fig. 39) and cluster gear shaft from gears and case.

(12) Remove main gear (2, fig. 38) and thrust washers (1 and 3).

(13) Using suitable knocker or press, remove bearings (4 and 5) from main idler gear (2).

(14) Remove preformed packing (7) from shaft (6).

(15) Remove cluster gear assembly (19) and thrust washers (18 and 20) from case.

(16) Using suitable knocker or press, remove bearings (16 and 17) from cluster gear assembly (19).

(17) Remove packing (11) from cluster gear shaft (15).

c. Assembly. Reverse procedure in *b* above.

d. Installation. Reverse procedures in *a* above.

e. Testing and Adjustment.

(1) With transmission oil at operating temperature, attach pressure gages of sufficient capacity in check ports (fig. 29).

Note. Check Port 4 is also regulator "D". When connecting into the line, do not remove the spring and ball behind the fitting.

(2) With control in neutral and engine running at 600 rpm, check transmission oil level. Fill as necessary.

(3) Adjust pressures to the limits as shown in the "Transmission Pressure Settings" below.

(4) Add or remove shims at regulators A, B, C, and D to increase or decrease pressure readings at check ports 1, 2, 3, and 4. Add shims to increase pressure; remove shims to decrease pressure.

Transmission Pressure Settings

Check port	Regulator	Set to	Control position	Range	
				600 rpm	2,400 rpm
1	A Pump and Hi-Lo	130 to 140 psi at 1,500 rpm	Neutral	110 psi	150 psi
2	B Forward and Reverse	85 to 95 psi at 1,500 rpm	Neutral	30–85 psi	150 psi
3	C Converter In	70–75 psi at 2,400 rpm	Neutral	5–55 psi	75 psi
4	D Converter Out		Neutral	2 psi	45 psi

39. Ring Gear Assembly

a. Removal. Refer to paragraph 38*b*, steps (1) through (3).

b. Disassembly.

(1) Remove snap ring (22, fig. 32) from ring gear assembly (30).

(2) Slide front cover (25) from gear assembly.

(3) Remove snap ring (28) that retains bearing (29) to ring gear assembly shaft.

(4) Using bearing puller remove bearing from shaft.

(5) Remove needle bearing from shaft housing if necessary.

c. Assembly. Reverse the procedures in *b* above.

d. Installation. Reverse the procedures in *a* above.

40. Planetary Carriage Assembly

a. Removal.

(1) Remove transmission (par. 38*a*).

(2) Remove planetary carriage assembly by following procedure in steps (1) through (4), paragraph 38*b*.

b. Disassembly.

(1) Remove thrust washer (fig. 34) from carriage assembly.

(2) Remove safety wires that secure place bolts.

(3) Mark the cage assembly and cover before disassembly.

(4) Remove place bolts (14, fig. 32) and retainer plate (13, fig. 17). Separate cover (12) from cage assembly (3).

(5) Remove gear (10) from cage assembly.

(6) Remove thrust washers (9 and 11) from gear (10).

(7) Remove pinion shafts (5), thrust washers (4 and 8), and pinion sets (6 and 7) from cage assembly.

Note. The 18-tooth pinion set (6) meshes with the sun gear (10). The 19-tooth pinion set (7) meshes with the ring gear assembly (30).

c. Assembly. Reverse procedures in *b* above. Lubricate all parts before assembly.

d. Installation. Reverse procedures in *a* above.

41. Forward-and-Reverse Clutch Assembly

a. Removal. Follow the procedures in steps (7) through (14), paragraph 38*a*.

b. Disassembly.

(1) Remove ring seals (11 and 12, fig. 40) from forward drive shaft assembly (9).

(2) Remove capscrews (21) that secure clutch assembly together.

Caution: **The clutch pack assembly will fall apart when removing the capscrews (21), due to spring tension inside the pack, if care is not exercised in removing capscrews.**

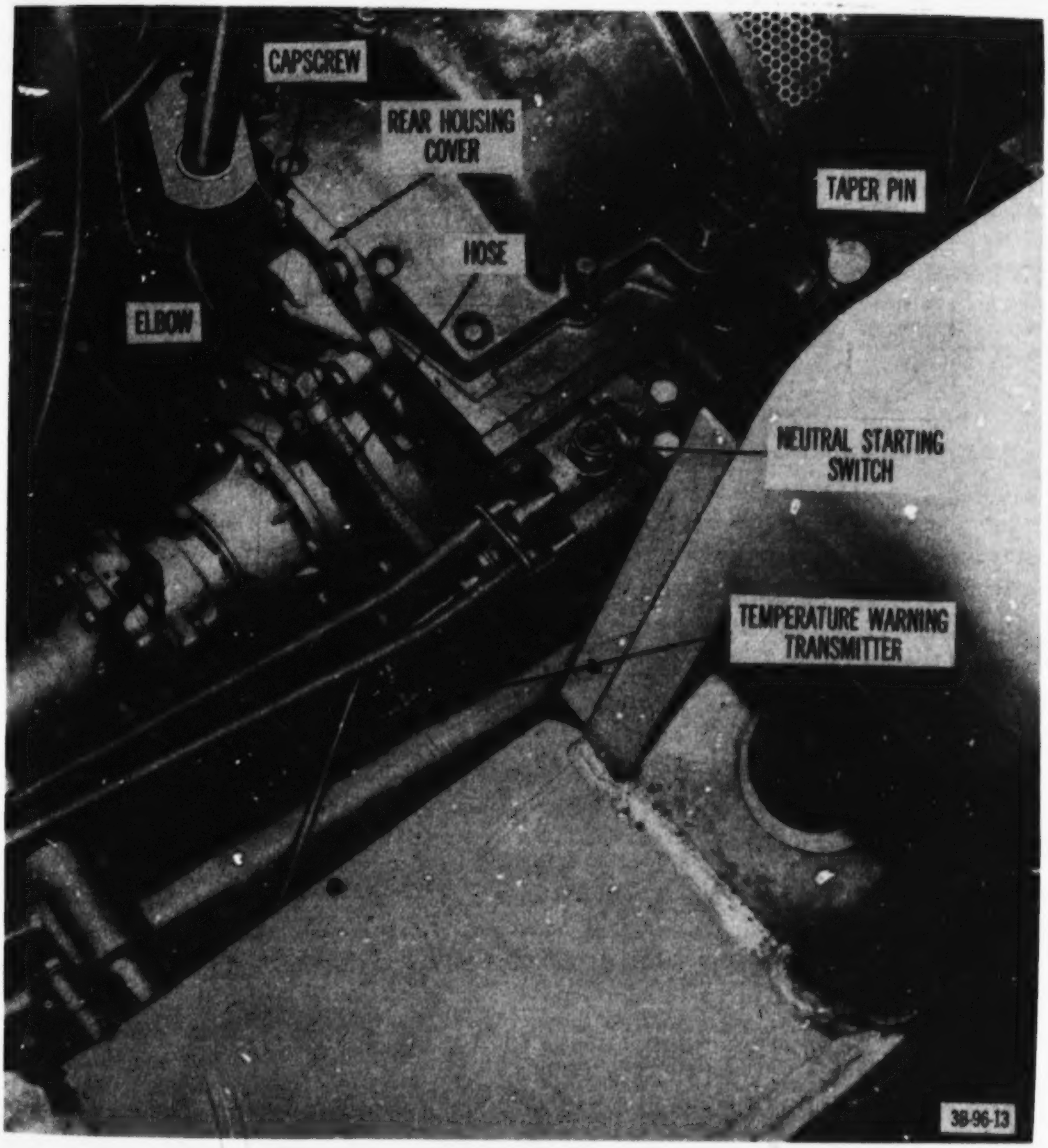

CAPSCREW
REAR HOUSING COVER
TAPER PIN
HOSE
ELBOW
NEUTRAL STARTING SWITCH
TEMPERATURE WARNING TRANSMITTER
38-96-13

Figure 25. Overhead side view of transmission and linkage, installed on truck.

(3) Remove housing end (1) from clutch assembly.

(4) Remove top separator plate (5) from top of retracting springs (36).

(5) After removing top separator plate from assembly, remove friction disks (35) and separator plates (5) alternately.

(6) Remove inner and outer retraction springs (36 and 37) from assembly.

(7) Remove clutch ring (6) from assembly.

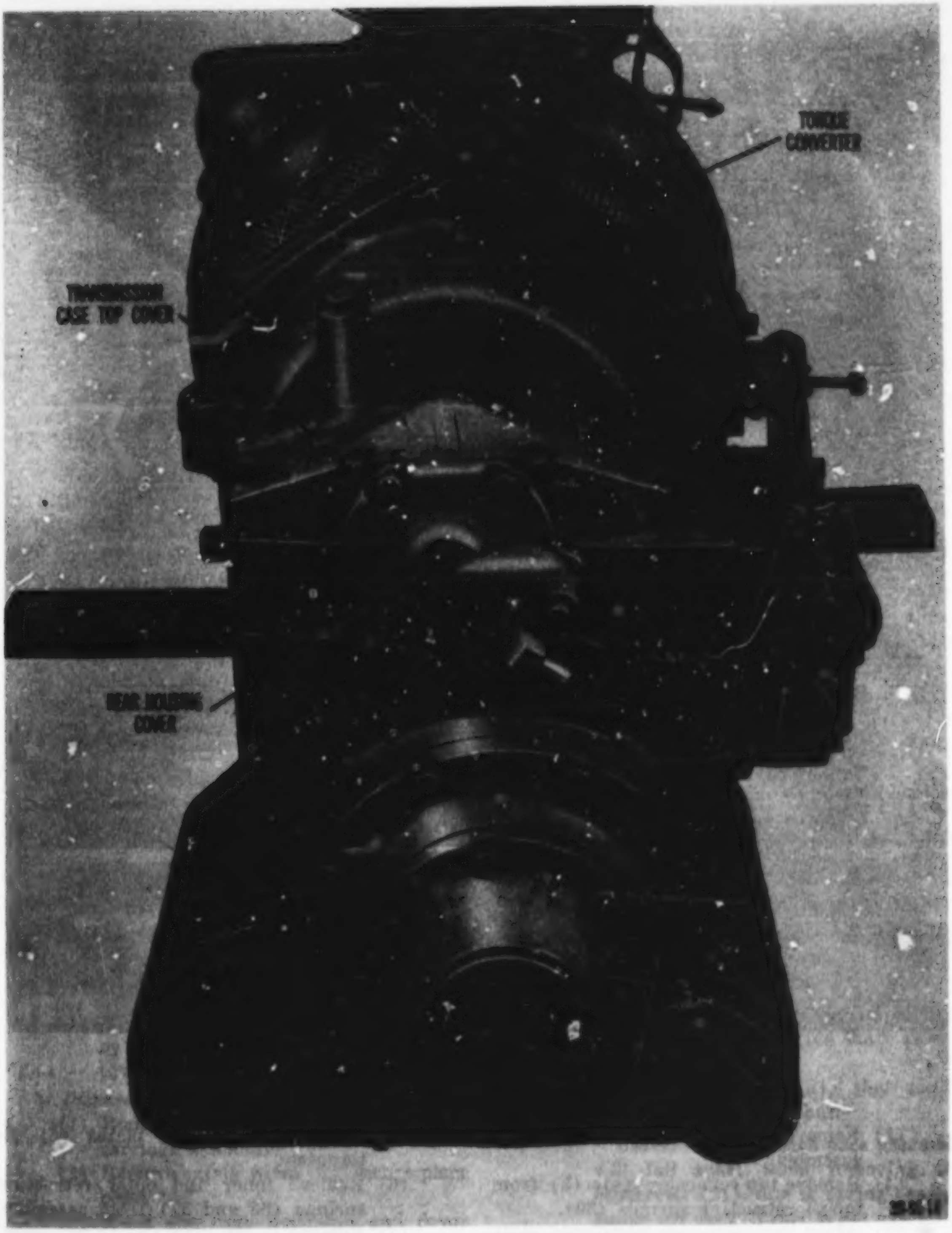

TORQUE CONVERTER
TRANSMISSION CASE TOP COVER
REAR HOUSING COVER

Figure 26. Front view of transmission, attached to torque converter.

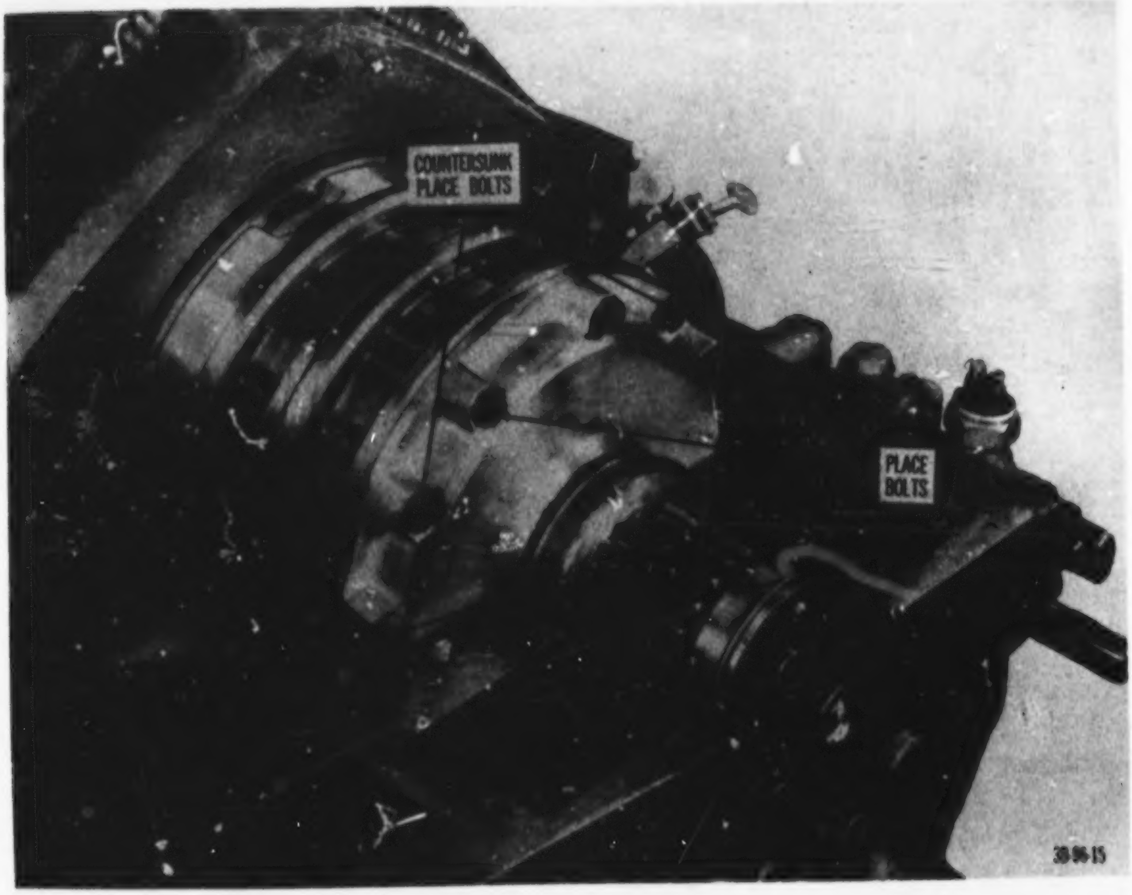


Figure 27. Forward-and-reverse clutch pack, mounted to drive plate.

(8) Remove separator ring plate (33) from assembly.

(9) Remove the lower inner and outer retraction springs (31 and 32) from assembly.

(10) Remove retaining ring (7) from shaft assembly (9).

(11) Remove bearings (2) from shaft assembly. Turn clutch pack assembly over and proceed from other end.

(12) Remove retaining ring (13) from shaft assembly (9).

(13) Remove bearing (15) from shaft assembly.

(14) Remove thrust washer (17) from shaft (9).

(15) Remove reverse drive gear assembly (18) from clutch pack.

(16) Remove thrust washer (10) from shaft assembly (9).

(17) Remove friction disks (30) and separator plates (34) alternately.

(18) Remove clutch ring (29) from front housing assembly (22).

(19) Remove retaining ring (28) from reverse gear assembly (18).

(20) Remove clutch hub (27) from gear assembly (18).

(21) Remove gear assembly (18) from housing assembly (22).

(22) Remove ring seals (19 and 20) from housing assembly (22).

(23) Remove clutch piston (25) from housing assembly (22) by turning housing assembly over and gently tapping the edges so the piston will fall out.

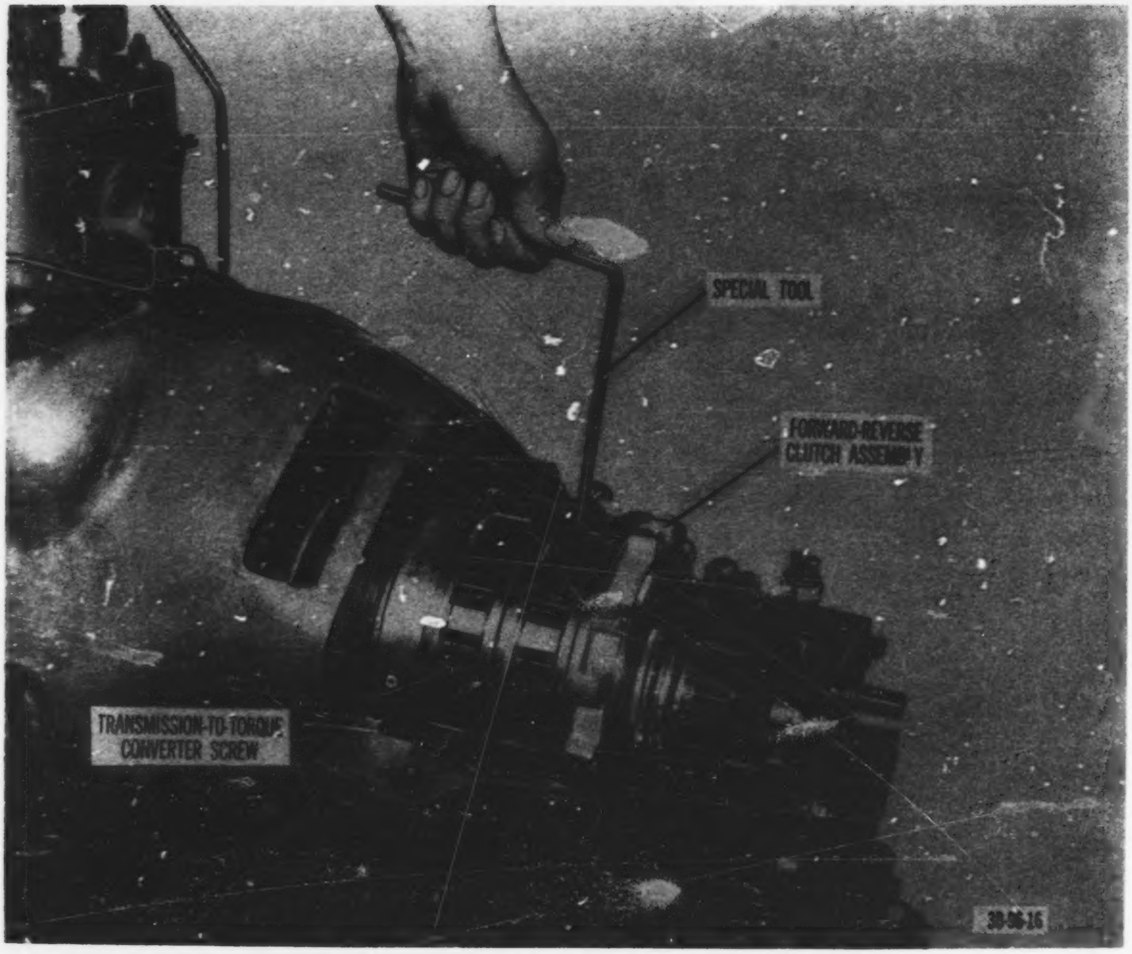

SPECIAL TOOL
FORWARD-REVERSE CLUTCH ASSEMBLY
TRANSMISSION-TO-TORQUE CONVERTER SCREW
30-96-16

Figure 28. Removing forward-and-reverse clutch pack.

(24) Remove inner and outer packing (23 and 24) from housing assembly (22).

(25) Remove piston (4) from end housing (1) by turning end housing over and gently tapping the edges so the piston will fall out.

c. Inspection. Inspect the clutch assembly as follows and replace damaged parts with new items:

(1) Check the gears for nicks, burs, or excessive wear.

(2) Check the thrust washers for scoring or excessive tang wear.

(3) Check the separator plates and friction disks for warpage or cracks.

(4) Check the clutch rings for wear caused by separator plate lugs.

(5) Check the bearings for wear or roughness.

d. Assembly.

Caution: **Make sure that the work area is clean. Lubricate all parts with OE–10 oil and assemble as follows:**

(1) Install new packing (23 and 24, fig. 40) in housing assembly (22).

(2) Install new packing (2 and 3) into end housing (1).

(3) Install clutch piston (4) into housing end.

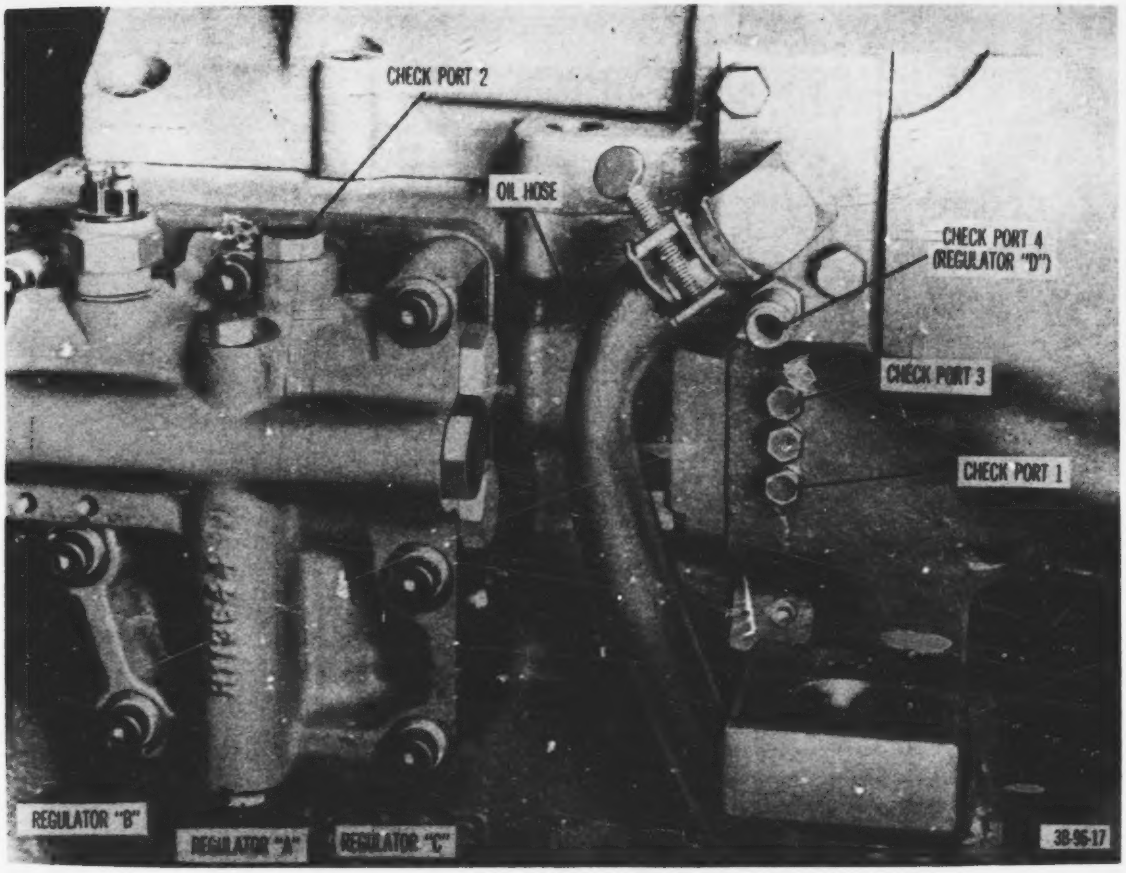


Figure 29. Left side view of transmission and control valve, showing oil check ports.

(4) Install reverse gear assembly (18) through end housing assembly (22) and then install clutch hub (27) on reverse gear assembly (18).

(5) Install retaining rings (26 and 28) on gear assembly (18).

(6) Place housing assembly on suitable jig to permit ease of reassembly of clutch assembly (fig. 41).

(7) Place clutch ring (fig. 42) on housing.

(8) Install four capscrews through clutch ring and clutch end to assure proper alinement of retainer bolt holes.

Note. All separator plates are "dished". Install all separator plates so that "dished" side is faced upward. To check for "dishing" of separator plate, lay the plate on smooth surface and use feeler gage (fig. 43).

(9) Install first separator plate so springs will rest on lugs of separator plate (fig. 42).

(10) Install friction disk (fig. 44); then install inner spring into outer spring. Install assembled springs on lugs of first separator plate in alinement according to figure 45.

(11) Install second separator plate with lugs indexed to allow seating of springs which rest on the first separator plate (fig. 45).

(12) Install separator plates and friction disks alternately until all separator plates and friction disks (fig. 46) are installed. The long slots on the friction disks must be alined (fig. 47).

(13) Install thrust washer (fig. 48), teeth side down on the forward gear. The

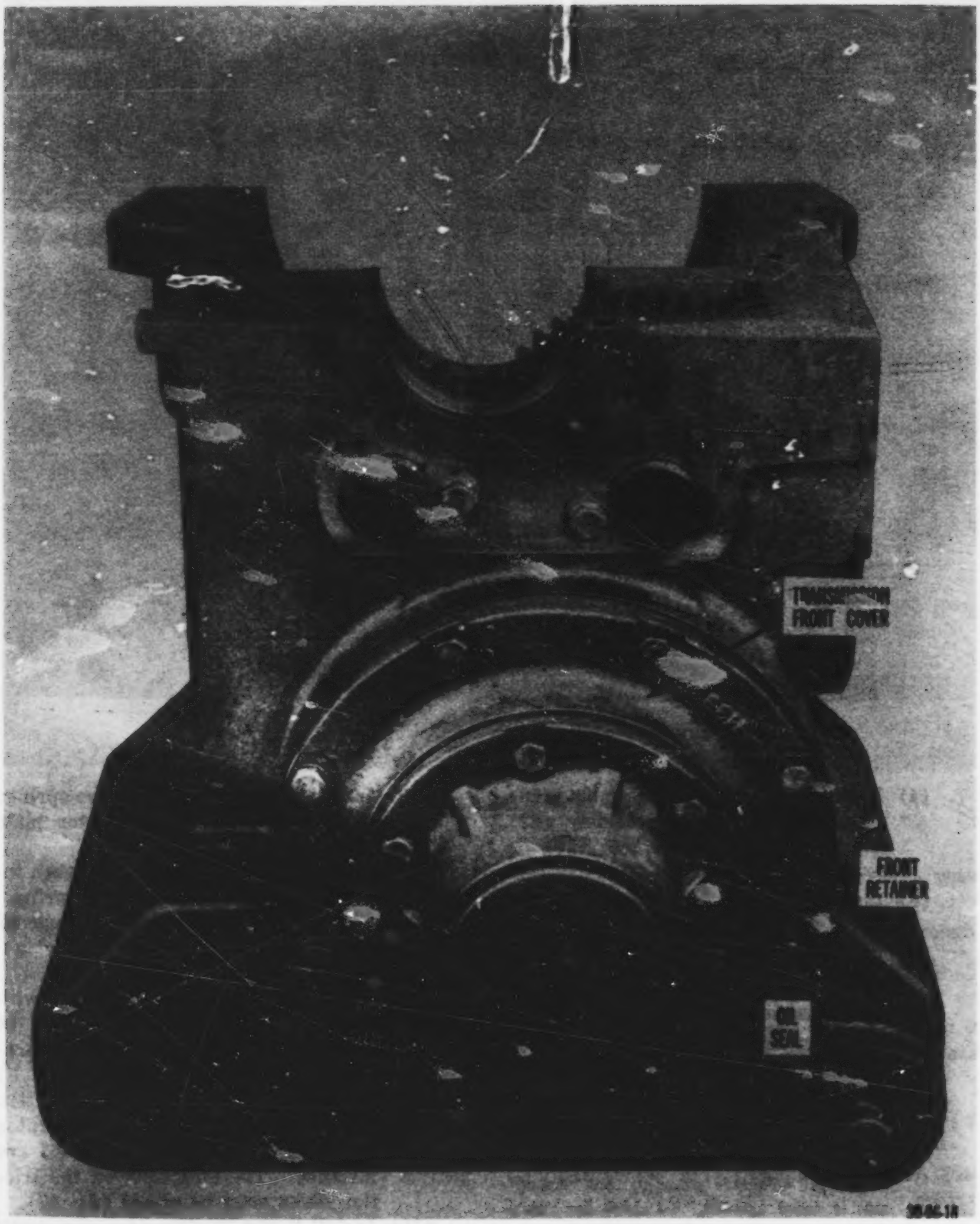

TRANSMISSION FRONT COVER
FRONT RETAINER
OIL SEAL
38-06-1A

Figure 30. Front view of transmission, removed from truck.

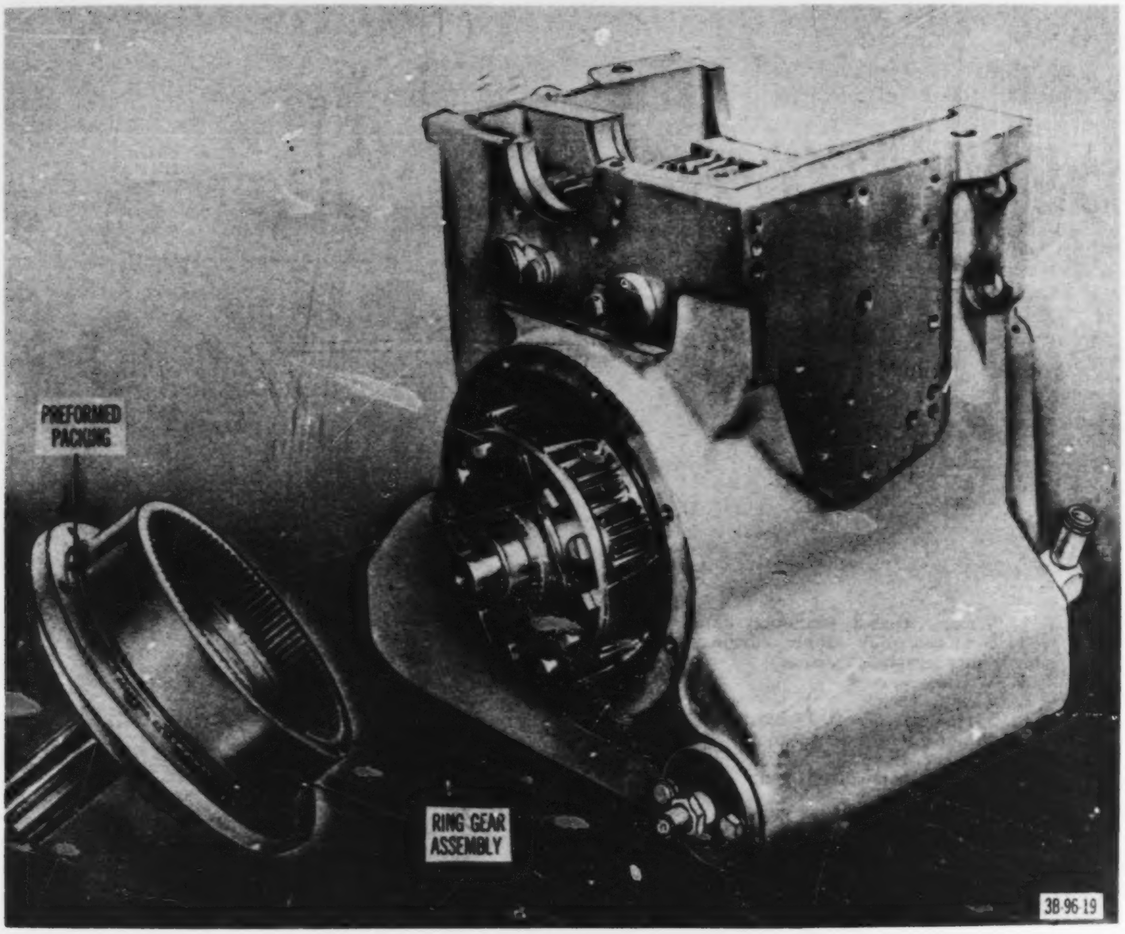


Figure 31. Ring gear assembly, removed from transmission.

teeth on the thrust washer must mesh with the teeth on the clutch hub.

(14) Install the forward drive shaft assembly into clutch hub.

(15) Place the thick separator plate on top of the springs. Be sure capscrew holes are alined (fig. 49).

(16) Install clutch ring on the thick separator plate.

(17) Install six friction disks and five separator plates alternately beginning with a friction disk.

Note. The long slots on the friction disks must be alined with each other and the blind spline on the forward drive shaft assembly (fig. 50).

(18) Install inner and outer spring assemblies in slots, making certain that springs rest on thick separator plates (fig. 51).

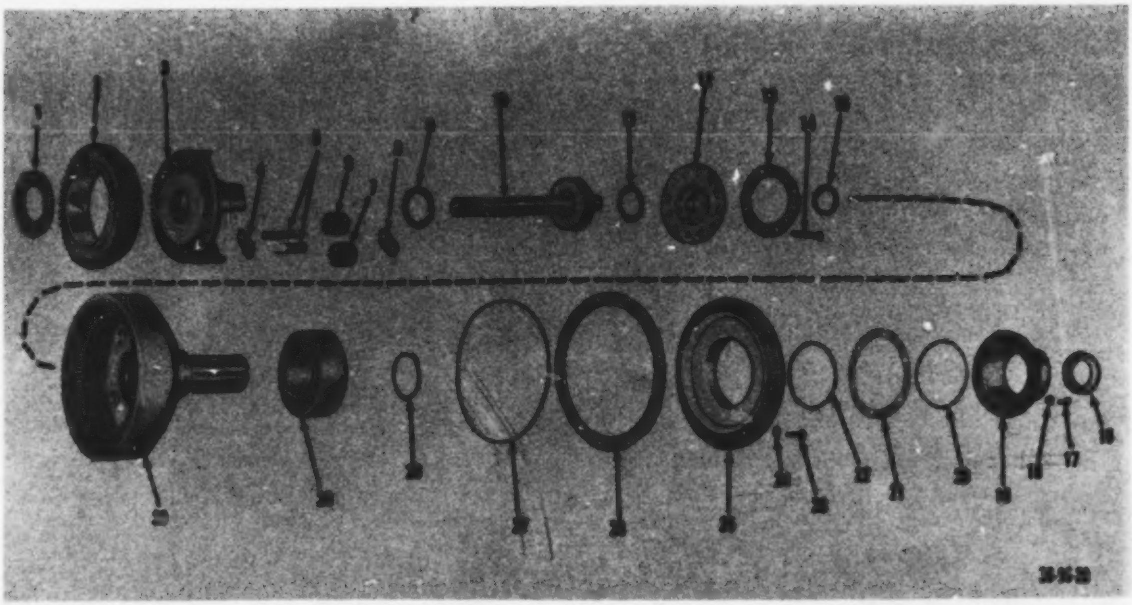
(19) Install the sixth separator plate with lugs resting on springs (fig. 52).

(20) Place housing end on assemblies.

(21) Press housing end to clutch assembly and install capscrews and torque capscrews to 15 foot-pounds.

Caution: **Make certain that top separator plate is alined with index of clutch ring before compressing end.**

(22) Install thrust washer on gear assembly with tangs indexed to gear.



1	Washer, thrust, planetary carriage
2	Gear assembly, planet, carriage, drive
3	Cage assembly, planet
4	Washer, thrust
5	Shafts, pinion
6	Pinion set, planet 18-tooth
7	Pinion set, planet 19-tooth
8	Washer, thrust
9	Washer, thrust, sun gear
10	Gear, sun, drive
11	Washer, thrust, sun gear
12	Cover, cage assembly planet
13	Plate, retainer
14	Bolt, place
15	Washer, thrust, sun gear
16	Seal, oil, ring gear hub
17	Capscrew
18	Lockwasher
19	Retainer, front
20	Packing, preformed
21	Shim, front retainer
22	Ring, snap
23	Capscrew
24	Lockwasher
25	Cover, front
26	Shim, front cover
27	Packing, preformed
28	Ring, snap
29	Bearing
30	Gear assembly, ring

Figure 32. Planetary carriage assembly, exploded view.

(23) Install forward drive gear on gear assembly (fig. 53).

(24) Install bearing on forward drive shaft assembly (fig. 54).

(25) Install ring retainer on forward drive shaft assembly.

(26) Install two ring seals (fig. 55) on forward drive shaft assembly.

(27) Install two ring seals on clutch end housing.

e. Installation. Reverse procedures in *a* above.

42. High-and-Low Clutch Assembly

a. Removal.

(1) Remove transmission (par. 38*a*).

(2) Remove high-and-low clutch assembly by following steps (1) through (7) in paragraph 38*b*.

b. Disassembly.

(1) Remove snap ring (1, fig. 56) and remove housing cover from clutch assembly.

(2) Remove two seal rings (3 and 4) from front of clutch assembly.

(3) Remove ring seals (19 and 20) from housing assembly (22).

(4) Remove thru screws (21) from clutch assembly.

***Caution:* The clutch assembly will fall apart when removing the thru screws (21) due to spring tension inside the pack, if care is not exercised in removing through screws.**

(5) Remove housing assembly (22) from clutch assembly.

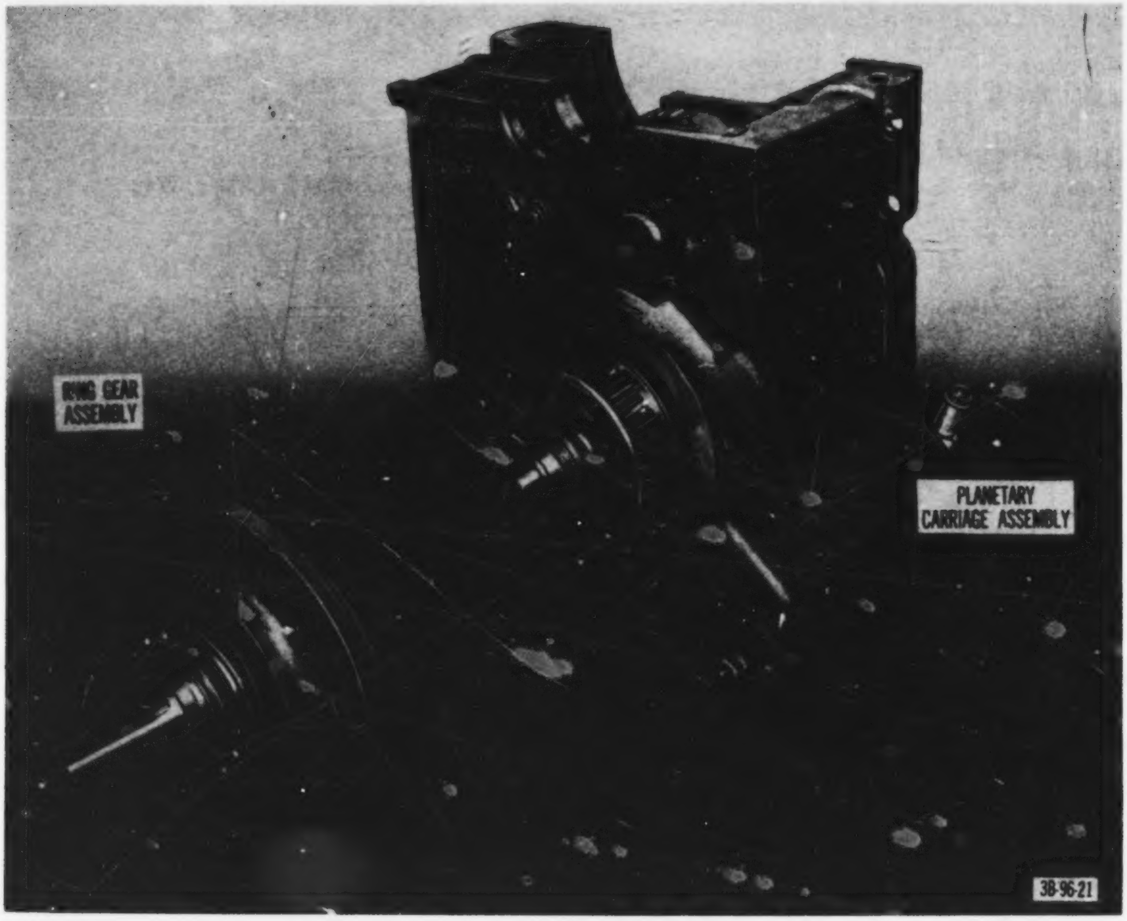


Figure 33. Planetary carriage assembly, installed on transmission.

(6) Remove top separator plate (26) from top of spring.

(7) Remove clutch springs (27) from clutch assembly.

(8) After removing top separator plate from assembly, remove friction disks (31) and separator plates (26) alternately.

(9) Remove disk ring (28) from clutch assembly.

(10) Remove separator plate (16) from clutch assembly.

(11) Remove hub assembly (29) from clutch assembly.

(12) Remove thrust washer (30) from clutch hub (13).

(13) Remove remaining friction disk (18) and separator plates (15) alternately from clutch assembly.

(14) Remove outer springs (17) from disk ring (14).

(15) Remove clutch ring (14) from clutch assembly.

(16) Remove high gear clutch shaft assembly (13) from clutch assembly.

(17) Remove bearing (12) from rear end housing (8).

(18) Separate high-and-low clutch hub (5) from rear end housing (8).

(19) Remove clutch piston (11) from rear end housing (8) by turning housing over and gently tapping the edges so the piston will fall out.

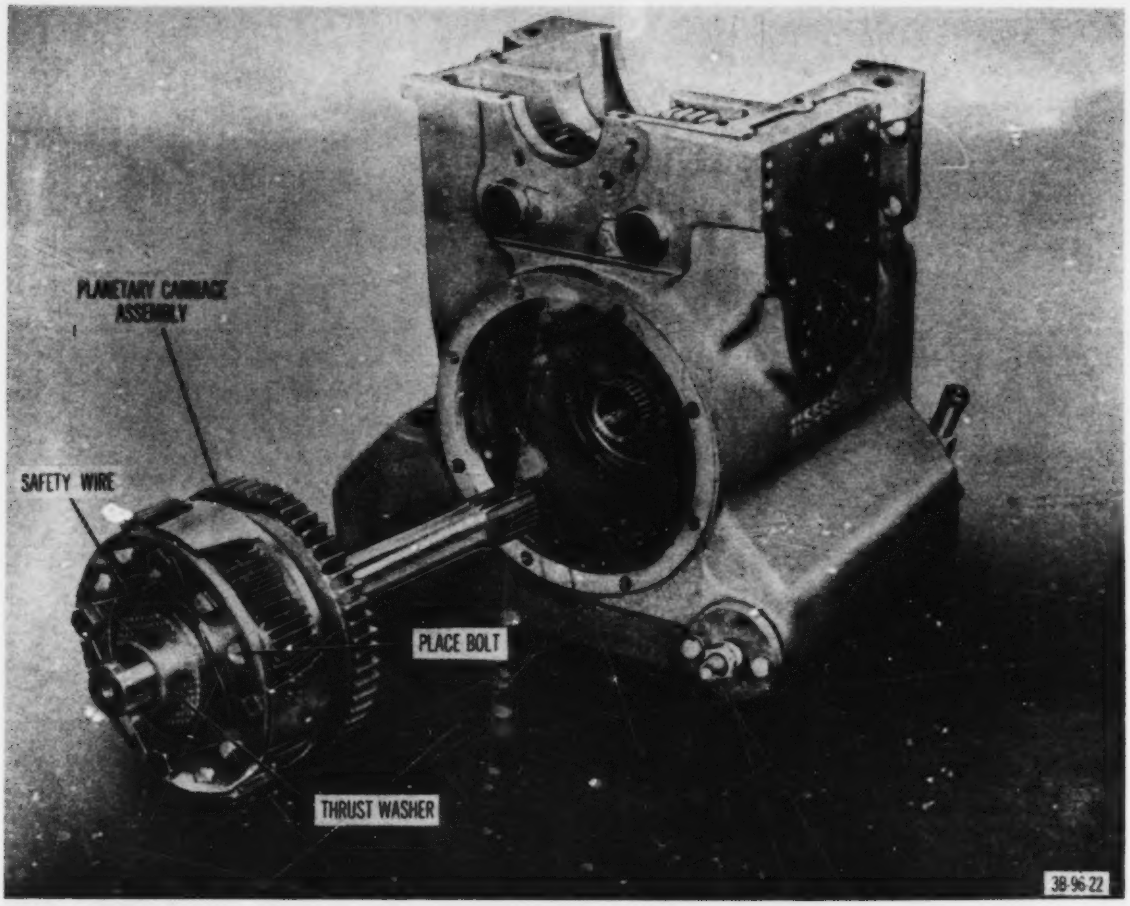


Figure 34. Planetary carriage assembly, removed from transmission.

(20) Remove inner and outer packing (9 and 10) from housing (8).

(21) Remove clutch piston (25) from front housing assembly (22) by turning housing over and gently tapping the edges so the piston will fall out.

c. Inspection. Inspect the clutch assembly as follows and replace damaged parts with new items:

(1) Check the high and low geras for nicks, burs, or excessive wear.

(2) Check the thrust washer for scoring or excessive tang wear.

(3) Check the separator plates and friction disks for warpage or cracks.

(4) Check the clutch rings for wear caused by separator plate lugs.

(5) Check the bearings for wear or roughness.

d. Assembly.

Caution: **Make sure that work area is clean. Lubricate all parts with OE–10 oil and assemble as follows:**

(1) Place high-and-low clutch hub on suitable stand to permit ease of reassembly of clutch assembly.

(2) Install new packing (9 and 10, fig. 56) in rear end housing (8).

(3) Install piston (11) in rear end housing.

(4) Install rear end housing on clutch hub (fig. 57), insuring alinement of actuating oil ports.

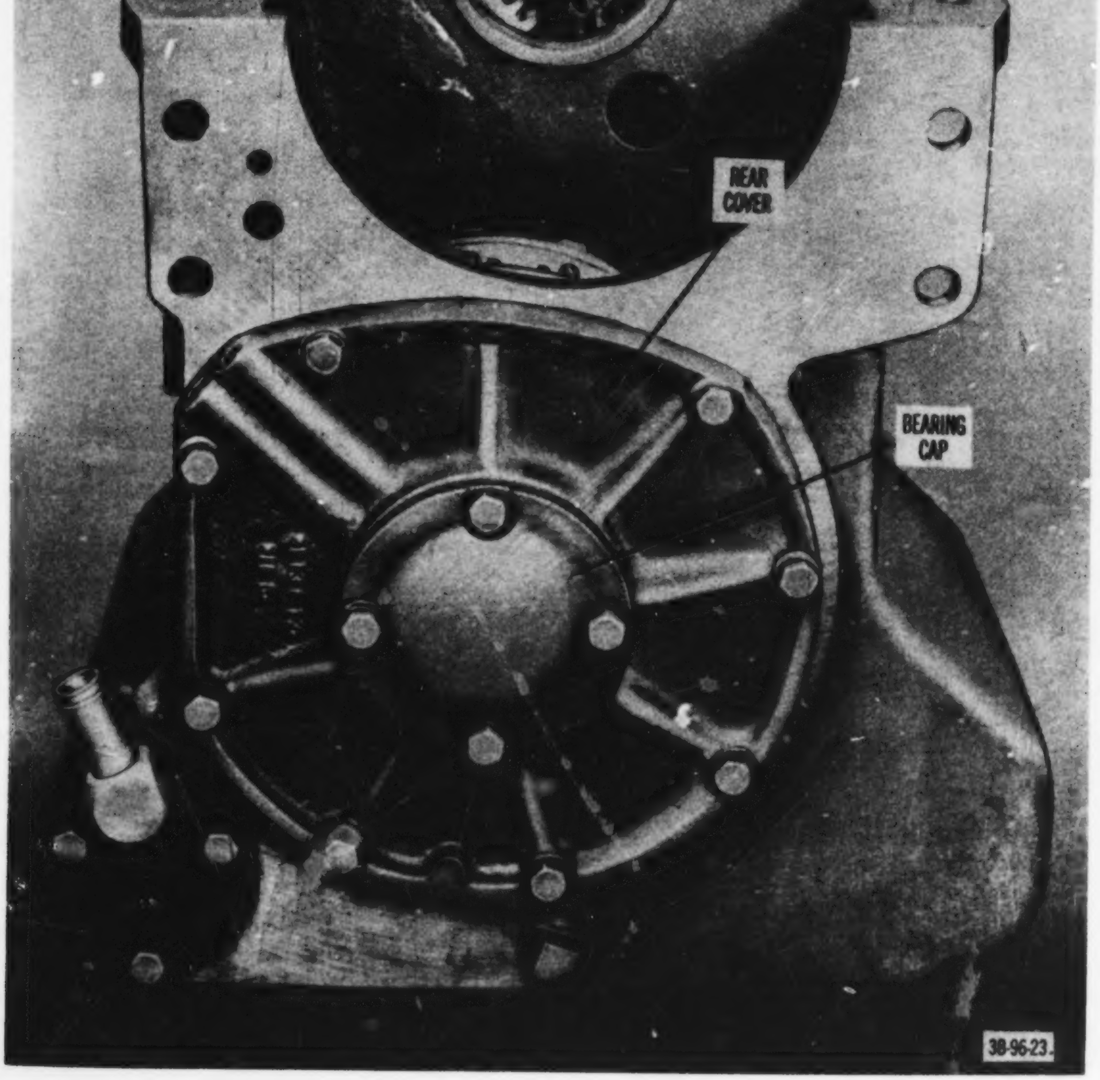

REAR COVER
BEARING CAP
38-96-23

Figure 35. Rear cover and bearing cap, installed on transmission case.

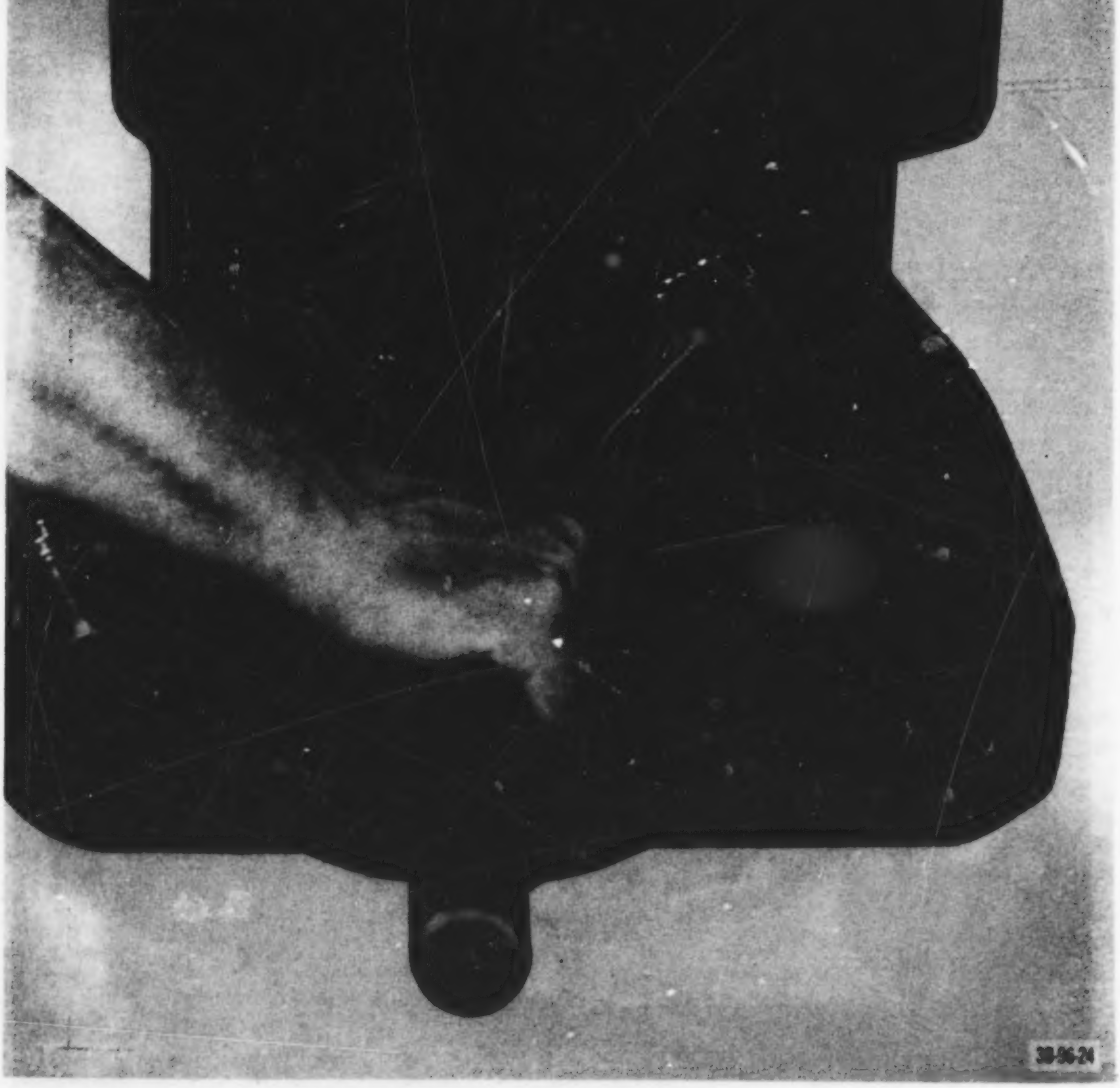


Figure 36. Removing high-and-low clutch pack.

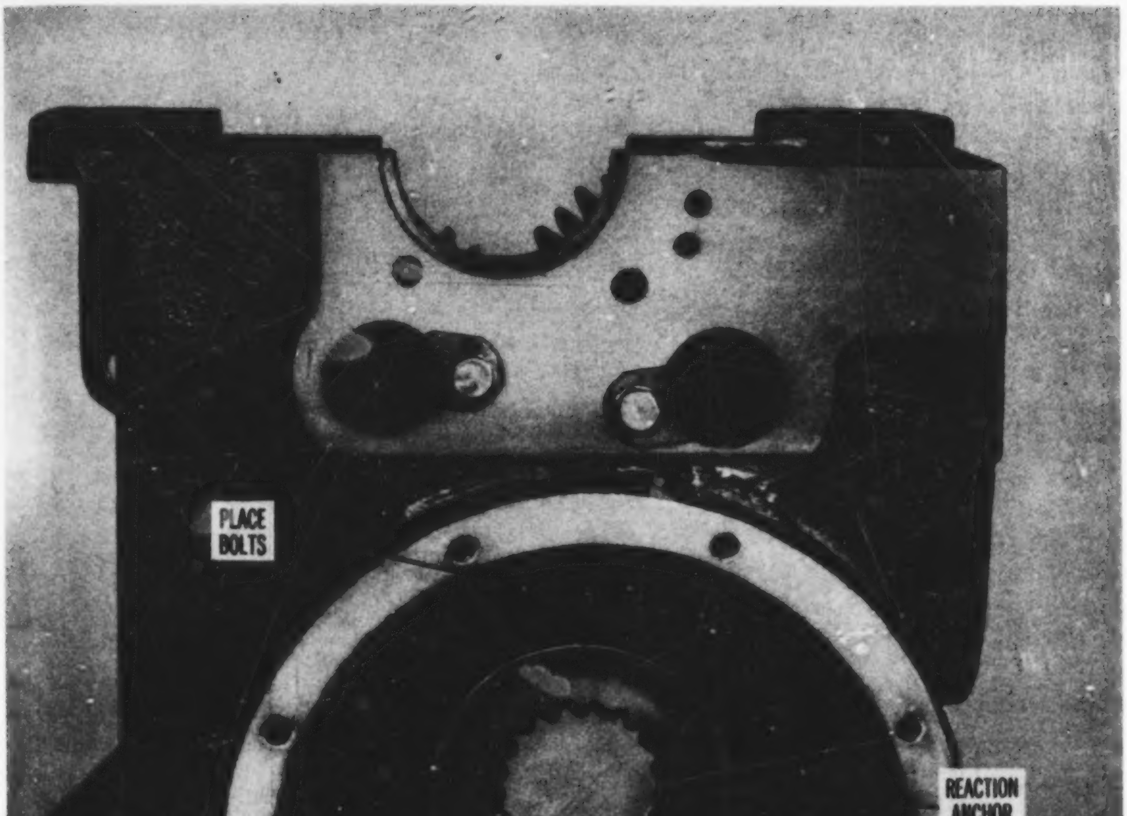
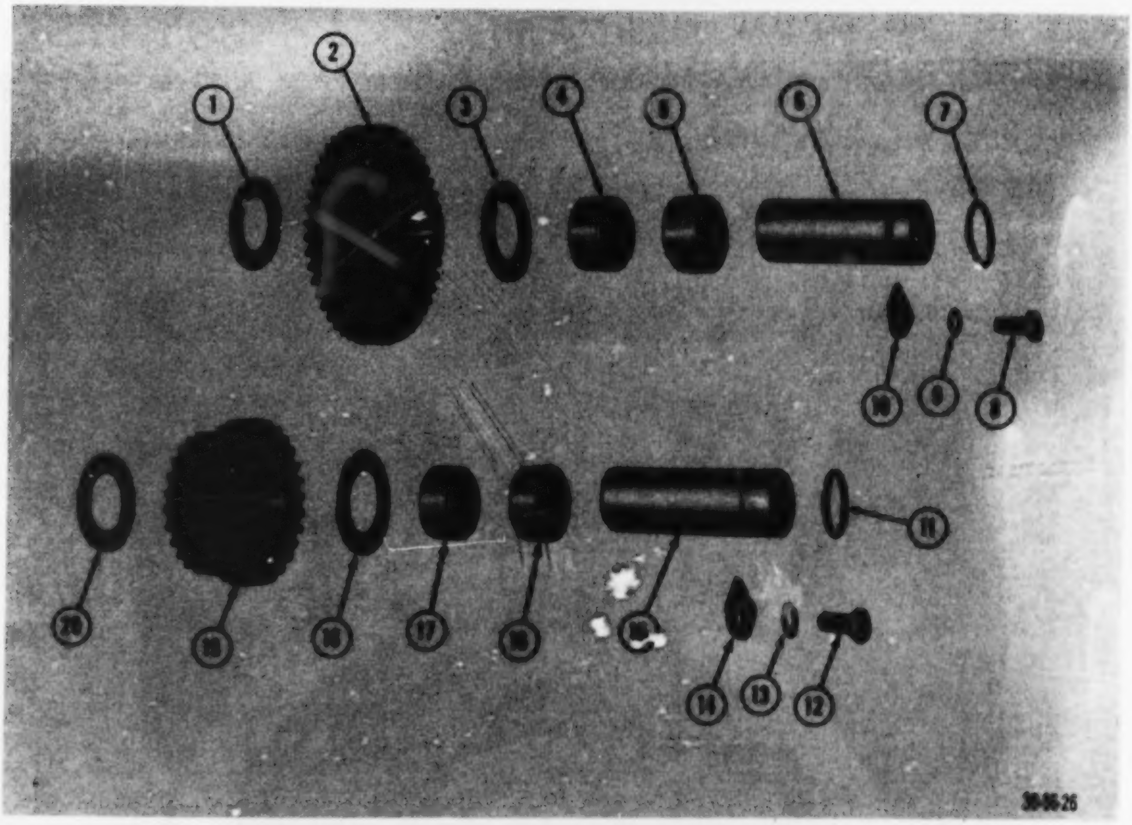

PLACE BOLTS
REACTION ANCHOR
3B-96-25

Figure 37. Reaction anchor installed in transmission case.



1	Washer, thrust
2	Gear assembly, idler
3	Washer, thrust
4	Bearing, roller, needle
5	Bearing, roller, needle
6	Shaft, idler gear
7	Packing, preformed, idler gear shaft
8	Capscrew
9	Lockwasher
10	Keeper
11	Packing, preformed, cluster gear
12	Capscrew
13	Lockwasher
14	Keeper
15	Shaft, cluster gear
16	Bearing, roller, needle
17	Bearing, roller, needle
18	Washer, thrust
19	Gear assembly, cluster
20	Washer, thrust

Figure 38. Transmission idler gear assembly, exploded view.

(5) Install bearing (12) on rear end housing (fig. 58).

(6) Drive high gear clutch hub over bearing (fig. 59).

(7) Place clutch ring on rear end housing (fig. 59).

(8) Install separator plate in clutch ring (fig. 59).

Note. All separator plates are "dished". Install all plates so that "dished" side is faced upward. To check for "dishing" of plates, lay the plate on smooth surface and use feeler gage (fig. 60).

(9) Install outer springs (fig. 59) on lugs of separator plate.

(10) Install friction disk and separator plates alternately until four disks and four plates are installed. Aline inner slots (fig. 61) on disks as they are installed.

(11) Install thrust washer (fig. 61) on high gear clutch hub.

(12) Install thick separator plate on hub (fig. 62).

(13) Install clutch hub assembly on high gear clutch hub (fig. 63).

(14) Install high gear disk ring (fig. 63) on hub.

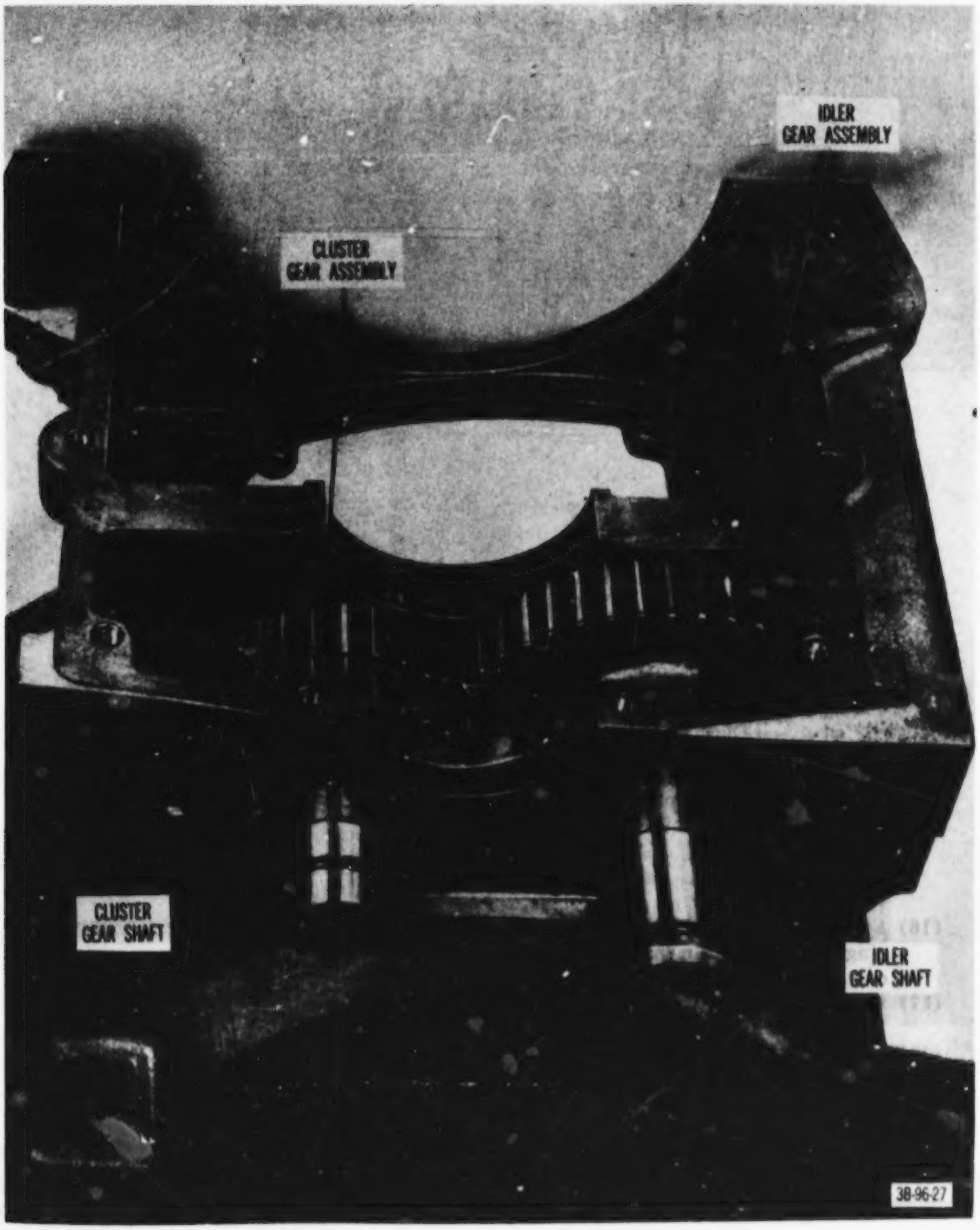
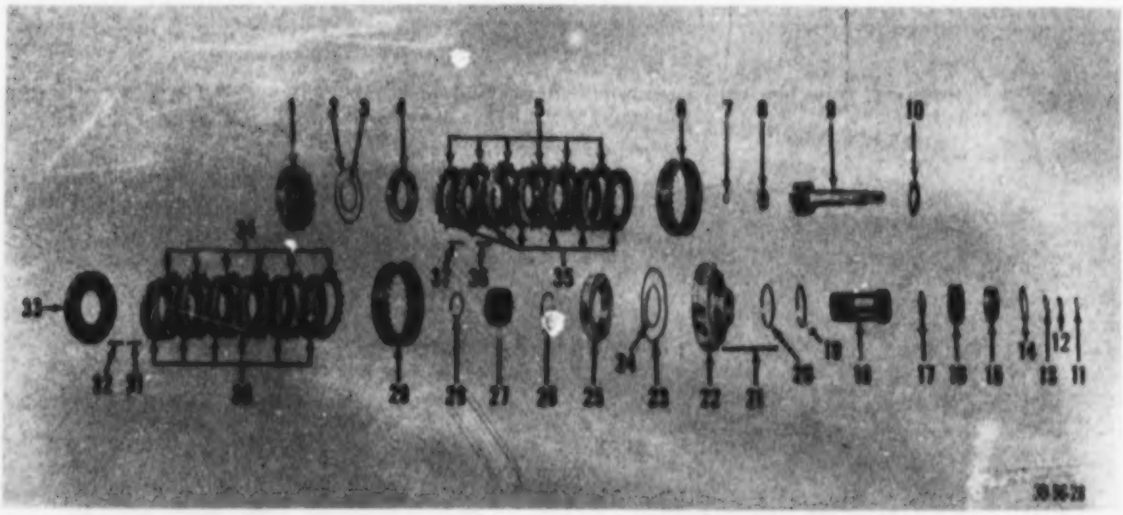

IDLER GEAR ASSEMBLY
CLUSTER GEAR ASSEMBLY
CLUSTER GEAR SHAFT
IDLER GEAR SHAFT
38-96-27

Figure 39. Idler gear assembly and cluster gear assembly, installed in transmission case.



1	Housing, end
2	Packing, preformed, piston, outer
3	Packing, preformed, piston, inner
4	Piston, clutch
5	Plates, separator, disk
6	Ring, clutch
7	Ring, retaining, drive shaft bearing, inner
8	Bearing, ball, annular, drive shaft
9	Shaft assembly, forward drive
10	Washer, thrust, forward drive gear
11	Seal, ring, shaft, front
12	Seal, ring, shaft, front
13	Ring, retaining
14	Ring, retaining
15	Bearing, ball, annular, housing end, rear
16	Gear, forward drive
17	Washer, thrust, forward drive
18	Gear assembly, reyerse drive
19	Seal, ring, clutch end housing, front
20	Seal, ring, clutch end housing, front
21	Screw, thru, clutch end housing
22	Housing assembly, end, front
23	Packing, preformed, piston, outer
24	Packing, preformed, piston, inner
25	Piston, clutch
26	Ring, retaining, hub
27	Hub, clutch
28	Ring, retaining, hub
29	Ring, clutch
30	Disks, friction
31	Spring, retraction, inner
32	Spring, retraction, outer
33	Plate, separator ring
34	Plates, separator, disk
35	Disks, friction
36	Spring, retraction, outer
37	Spring, retraction, inner

Figure 40. Forward-and-reverse clutch assembly, exploded view.

(15) Install and aline eight friction disks and seven separator plates alternately beginning with friction disks (fig. 64).

Note. Insure friction disk "inner slot" alinement.

(16) Install clutch springs in index of disk ring, making certain that springs seat on thick separator plate (fig. 64).

(17) Install last seperator plate so that lugs rest on springs (fig. 65).

(18) Install front end housing on clutch assembly. Compress housing assembly and install thru screws (fig. 66). Torque thru screws to 15 foot-pounds.

Caution: **Make certain that top separator plate is alined with index of disk ring before compressing housing assembly.**

(19) Install seal rings on housing assembly (fig. 66).

(20) Install seal rings on high-and-low clutch hub on opposite side of clutch assembly (fig. 67).

e. Installation. Reverse procedures in *a* above.

43. Torque Converter Assembly

a. Removal.

(1) Remove transmission (par. 38*a*).

(2) Remove starter (TM 10-3930-222-20).

(3) Support engine with suitable blocks.

(4) Remove nuts, washers, spacers, star washers, and pads from rear engine mount.

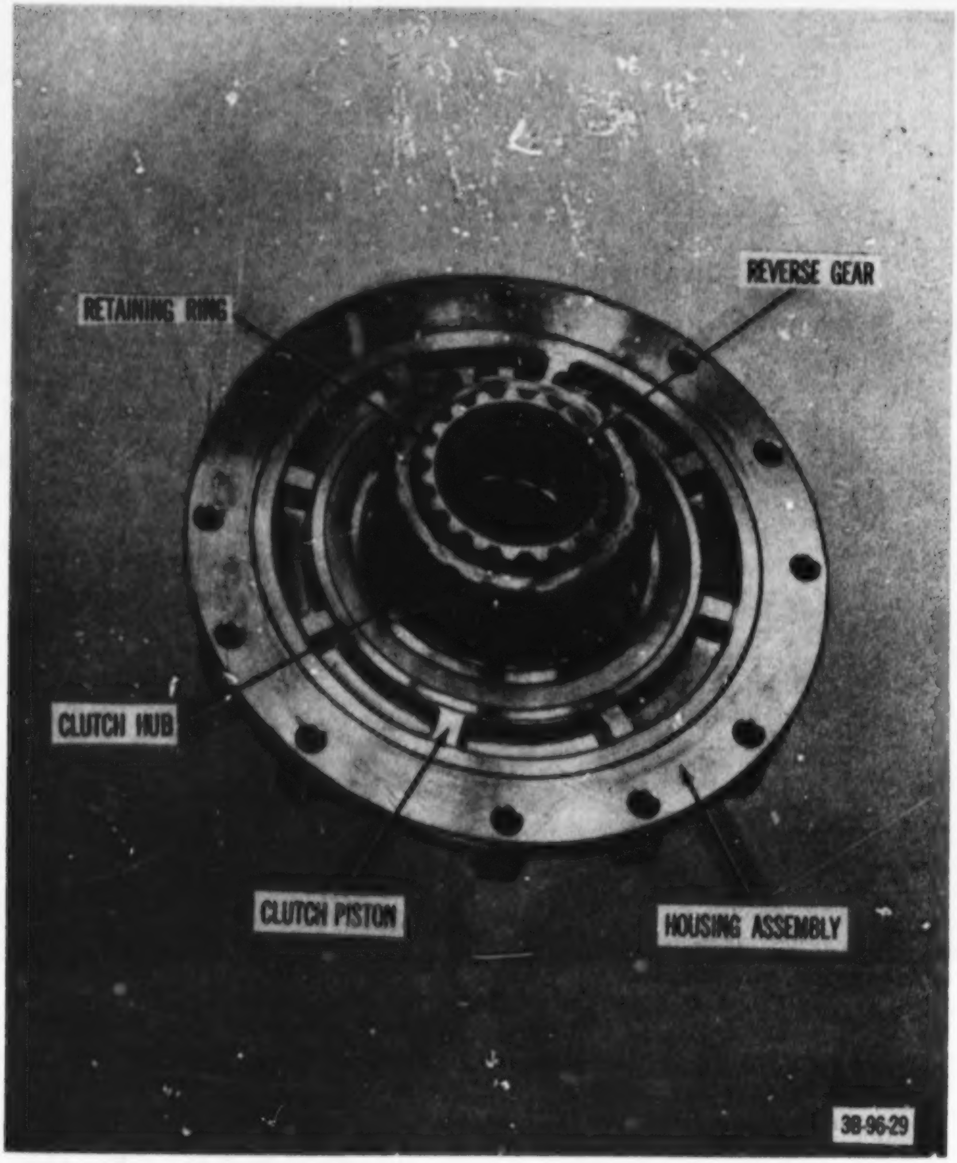

RETAINING RING
REVERSE GEAR
CLUTCH HUB
CLUTCH PISTON
HOUSING ASSEMBLY
38-96-29

Figure 41. Front end housing assembly, removed from transmission.

(5) Remove capscrews and lockwashers that secure torque converter housing to adapter plate.

(6) Using suitable hoist, remove torque converter housing (1, fig. 68).

(7) Remove capscrews that secure engine mount to housing and remove mount.

(8) Turn converter until mounting bolt alines with starter opening (fig. 69). Remove locknut, spacer, and mounting bolt. Turn torque converter and remove the remaining five locknuts, spacers, and mounting bolts. Remove the torque converter from the adapter plate.

(9) Remove locknuts and flat washers that secure converter mounting plate and hub (fig. 70) to crankshaft and remove plate and hub.

b. Disassembly.

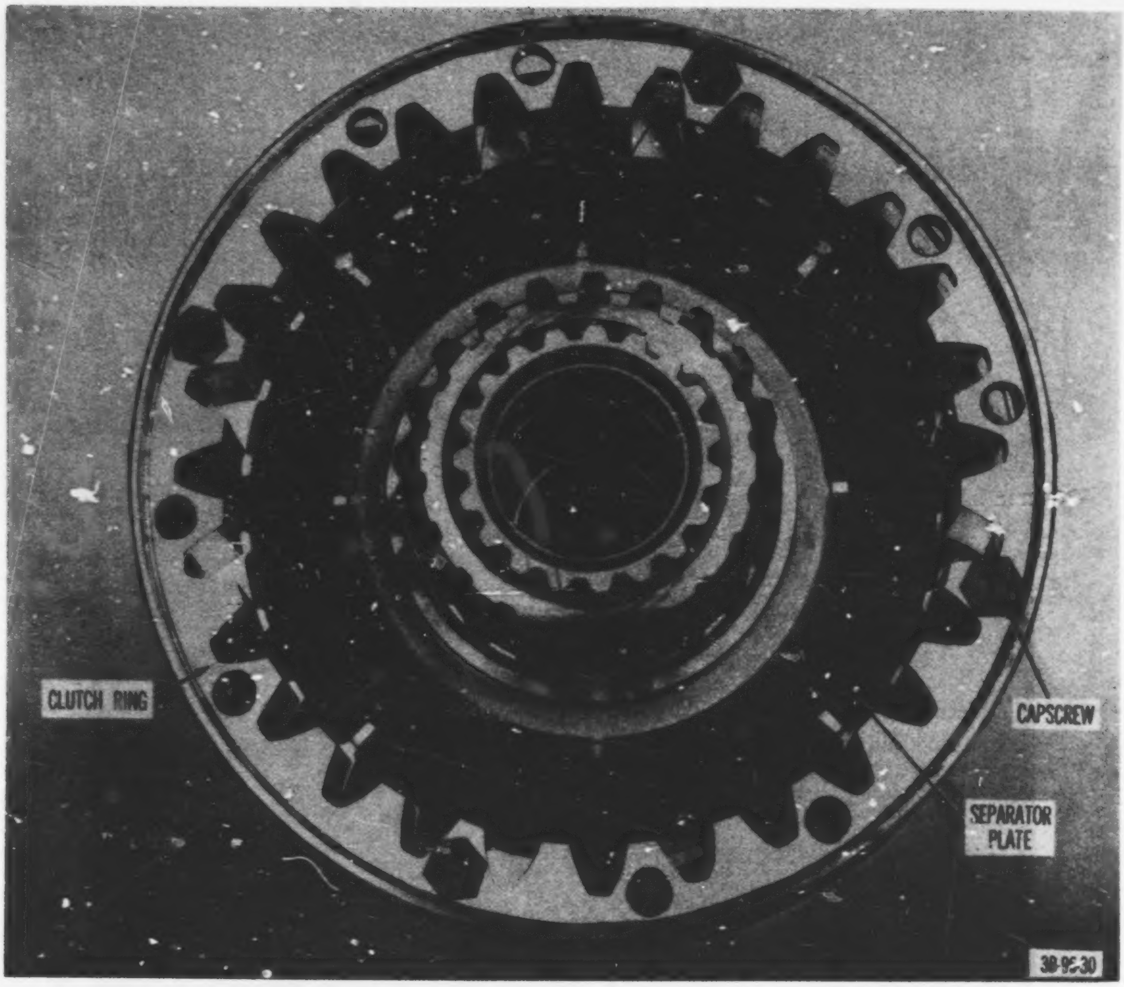


Figure 42. Clutch ring installed on front end housing assembly.

(1) Remove bolts (15, fig. 71) and washers (16) that secure pump assembly (12) to converter housing (4) and remove pump.
(2) Remove pump gasket (11), mounting plate (10), gasket (9), and packing (8) from housing.
(3) Remove retaining ring (7) from main shaft (1) and drive the shaft from the housing.
(4) Remove bearing (6) from housing.
(5) Remove ring seal (2) from main shaft (1).
(6) Remove three screws (17) that secure baffle plate (5) to housing (4) and remove plate.
(7) Remove capscrews (26 and 28) and lockwashers (25 and 29) that secure adapter plate (23) to housing and remove plate and gasket (22).
(8) Remove spring (20) and ball (19) from housing.

c. Inspection. Inspect parts for wear, cracks, and breaks.

d. Assembly. Reverse procedures in *b* above using new gaskets and new packing.

Caution: **Make certain that lugs on torque converter fit into slots on pump drive gear.**

e. Installation. Reverse procedures in *a* above.

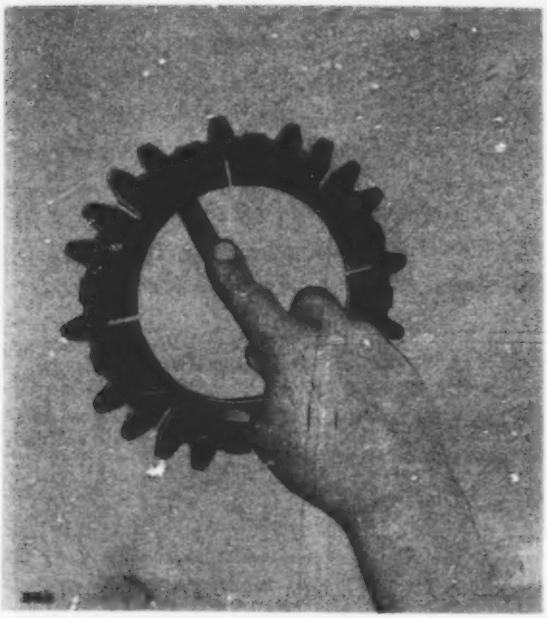


Figure 43. Checking for "dishing" of separator plate.

44. Transmission Control Valve

a. Removal.

(1) Disconnect transmission control valve linkage (TM 10-3930-222-20).

(2) Disconnect safety switch wires. Unscrew and remove the safety switch.

(3) Remove screws and flat washers (fig. 72) that secure control valve to transmission case and remove control valve and control valve gasket (fig. 73).

(4) Remove mounting screws and flat washers that secure porting plate to case and remove plate and porting plate gasket (fig. 73).

b. Disassembly.

(1) Remove plugs (1 and 35, fig. 74).

(2) Remove packing (2 and 34) from plugs.

(3) Remove springs (3 and 33) from control valve.

(4) Remove balls (4 and 32) from control valve.

(5) Remove plugs (6, 8, and 9) from control valve.

(6) Remove spring (11) from control valve.

(7) Remove packing (5, 7, and 10) from plugs (6, 8, and 9).

(8) Withdraw inching spool (26), high-and-low spool (28), and forward-and-reverse spool (29) from control valve.

(9) Remove oil seals (25, 27, and 30) from control valve.

(10) Remove retainers (15, 16, and 17) and gaskets (14, 18, and 19) from control valve.

(11) Remove spring (13) and plunger (12) from control valve.

(12) Remove spring (21) and plunger (23) from control valve.

(13) Remove spring (20) and plunger (22) from control valve.

c. Cleaning and Inspection.

(1) Clean all parts with SD and dry them with a clean cloth or compressed air.

(2) Inspect spools for nicks, burs, and wear.

(3) Inspect spool ports for deposits of foreign matter, nicks, and burs.

(4) Inspect the springs for lost tension and breaks.

d. Repair. Replace defective parts with serviceable ones.

e. Assembly. Using new seals and packing, reverse procedures in *b* above.

f. Installation. Reverse procedures in *a* above.

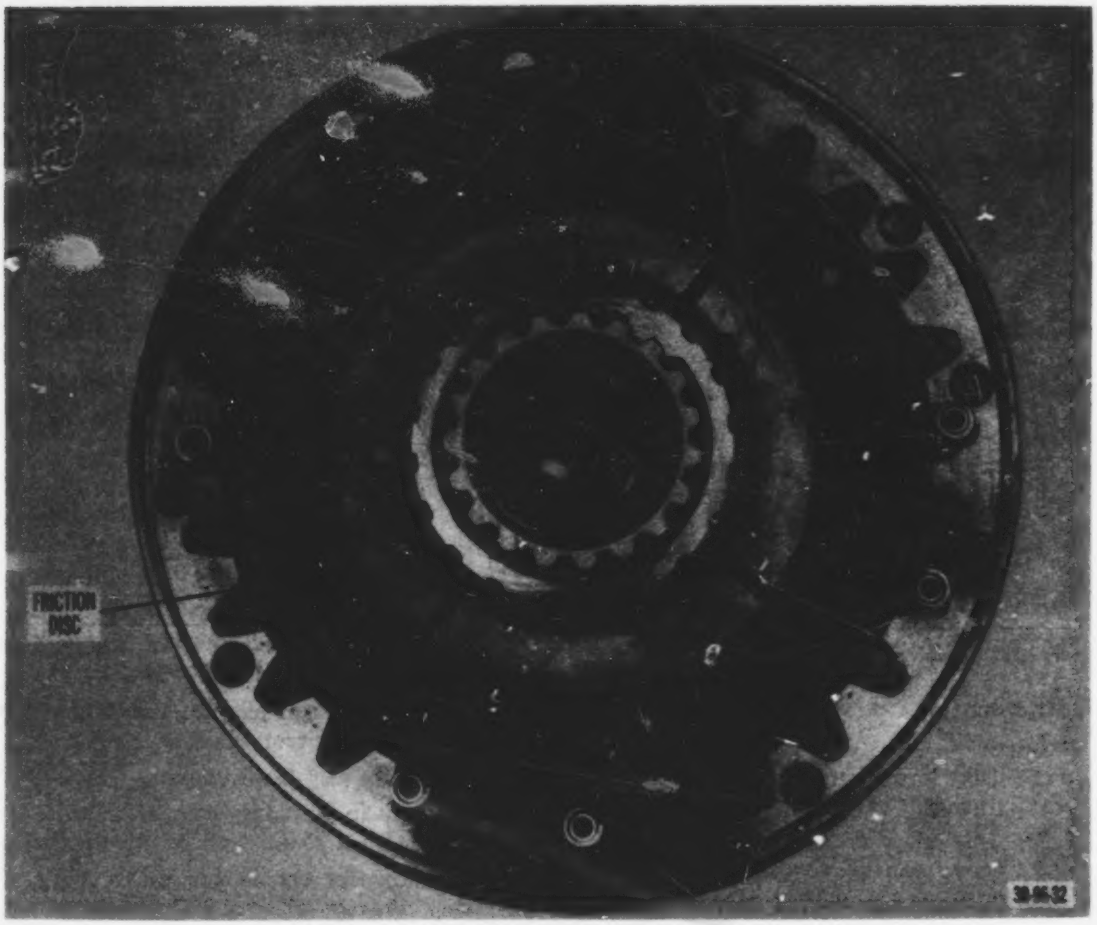
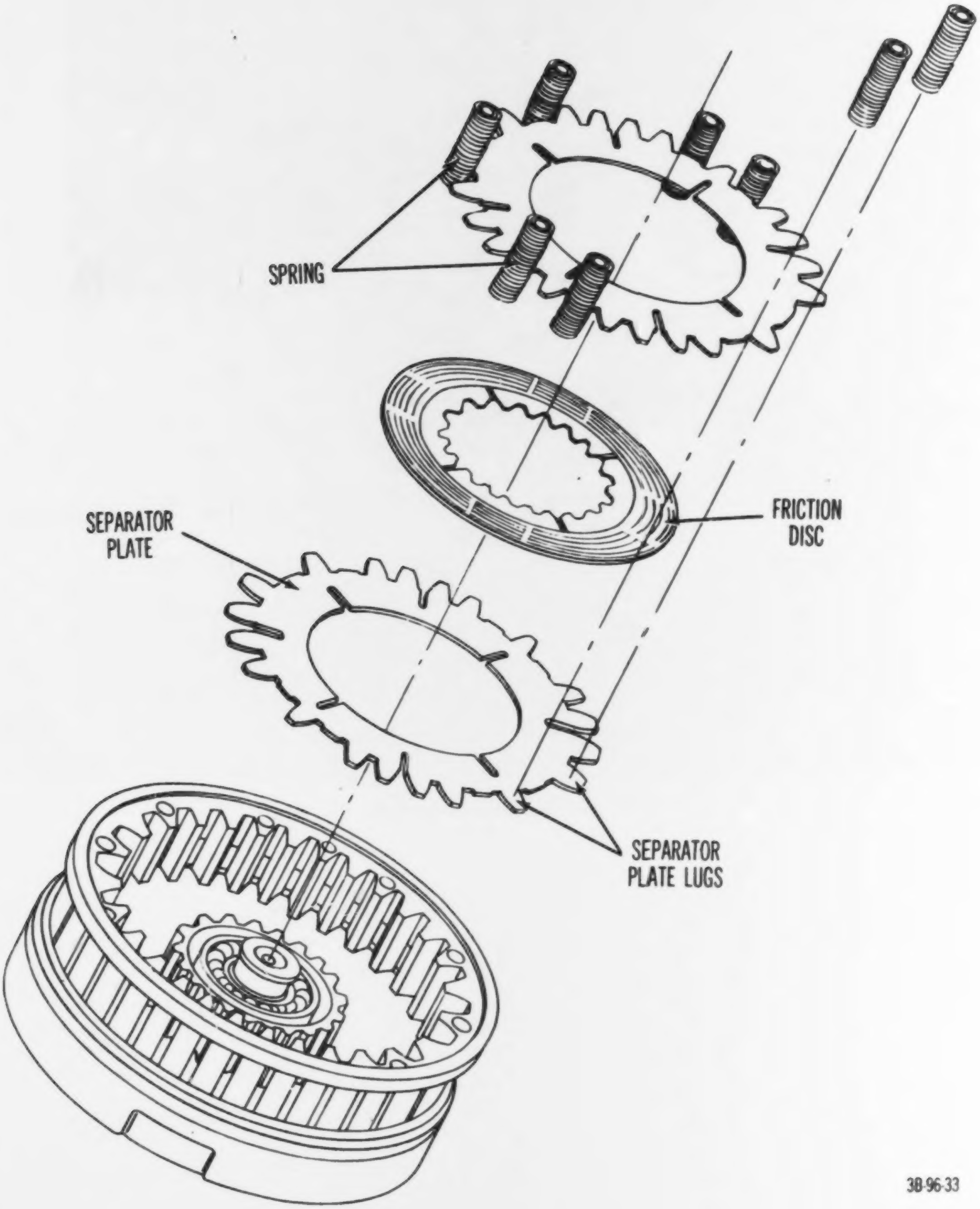

FRICTION DISC
30-66-32

Figure 44. Assembled retraction springs installed on lugs of separator plate.



SPRING
FRICTION DISC
SEPARATOR PLATE
SEPARATOR PLATE LUGS
3B-96-33

Figure 45. Alinement of retraction springs, friction disk, and separator plates.

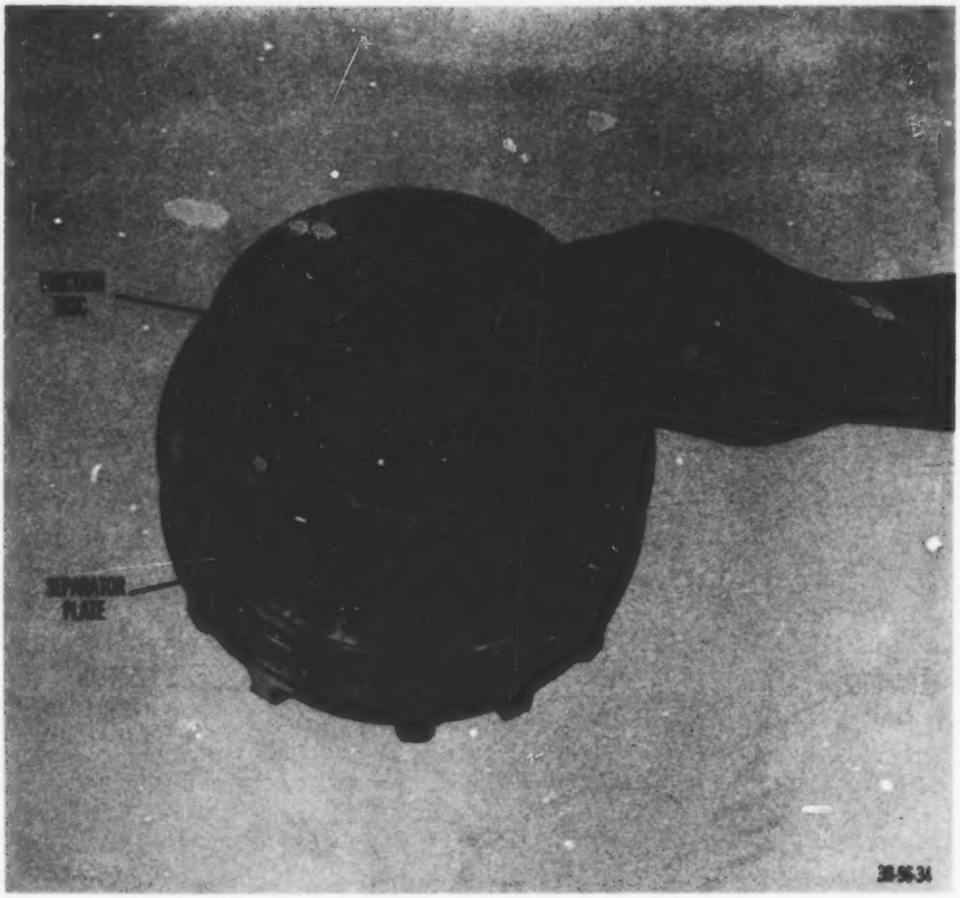

FRICTION DISC
SEPARATOR PLATE

Figure 46. Installing friction disk and separator plate.

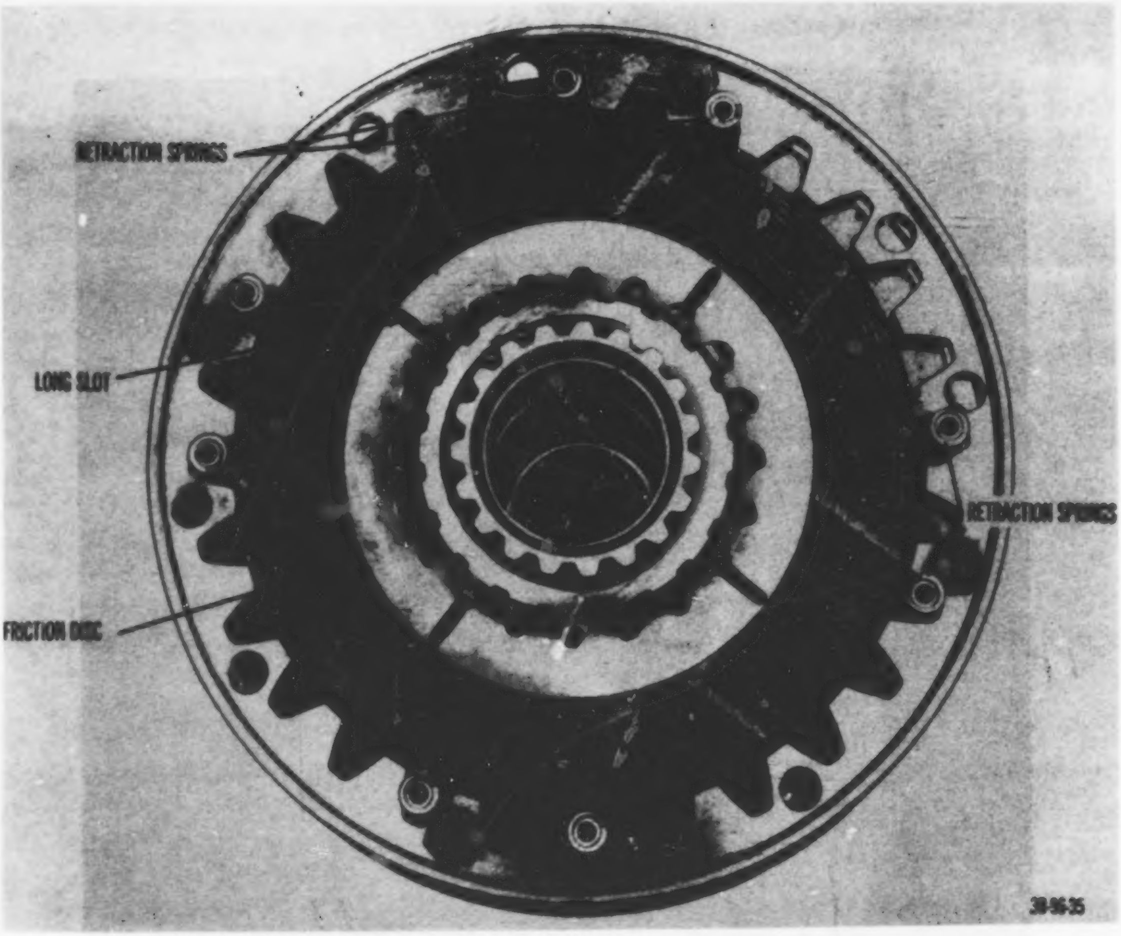

RETRACTION SPRINGS
LONG SLOT
FRICTION DISC
RETRACTION SPRINGS
38-9635

Figure 47. Friction disks installed with slots alined.

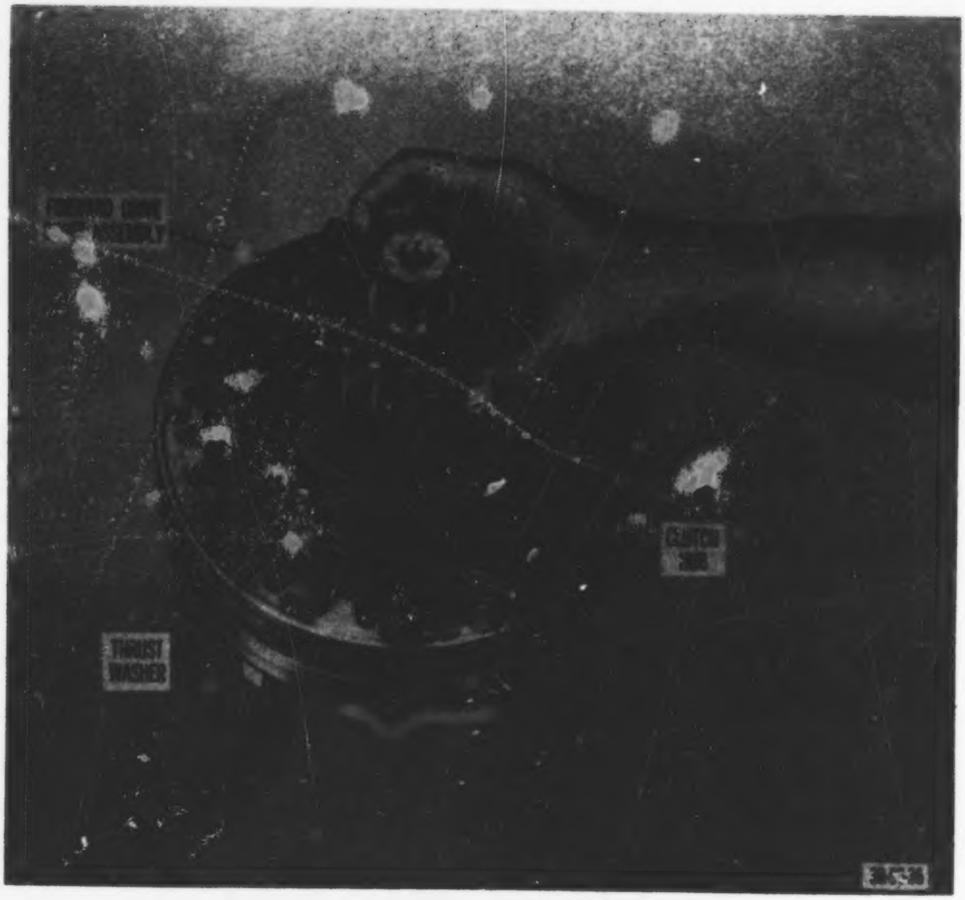

FORWARD DRIVE SHAFT ASSEMBLY
CLUTCH HUB
THRUST WASHER

Figure 48. Installing thrust washer and forward drive shaft assembly.

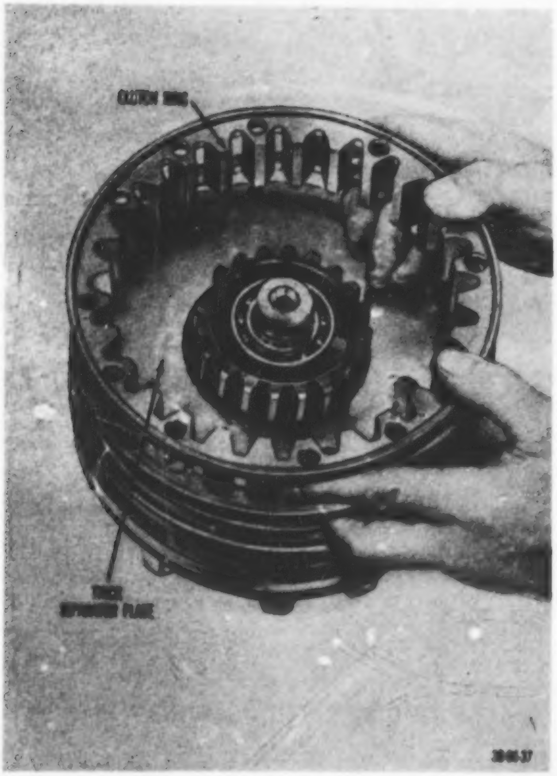

CLUTCH RING
THICK SEPARATOR PLATE

Figure 49. Installing thick separator plate and clutch ring.

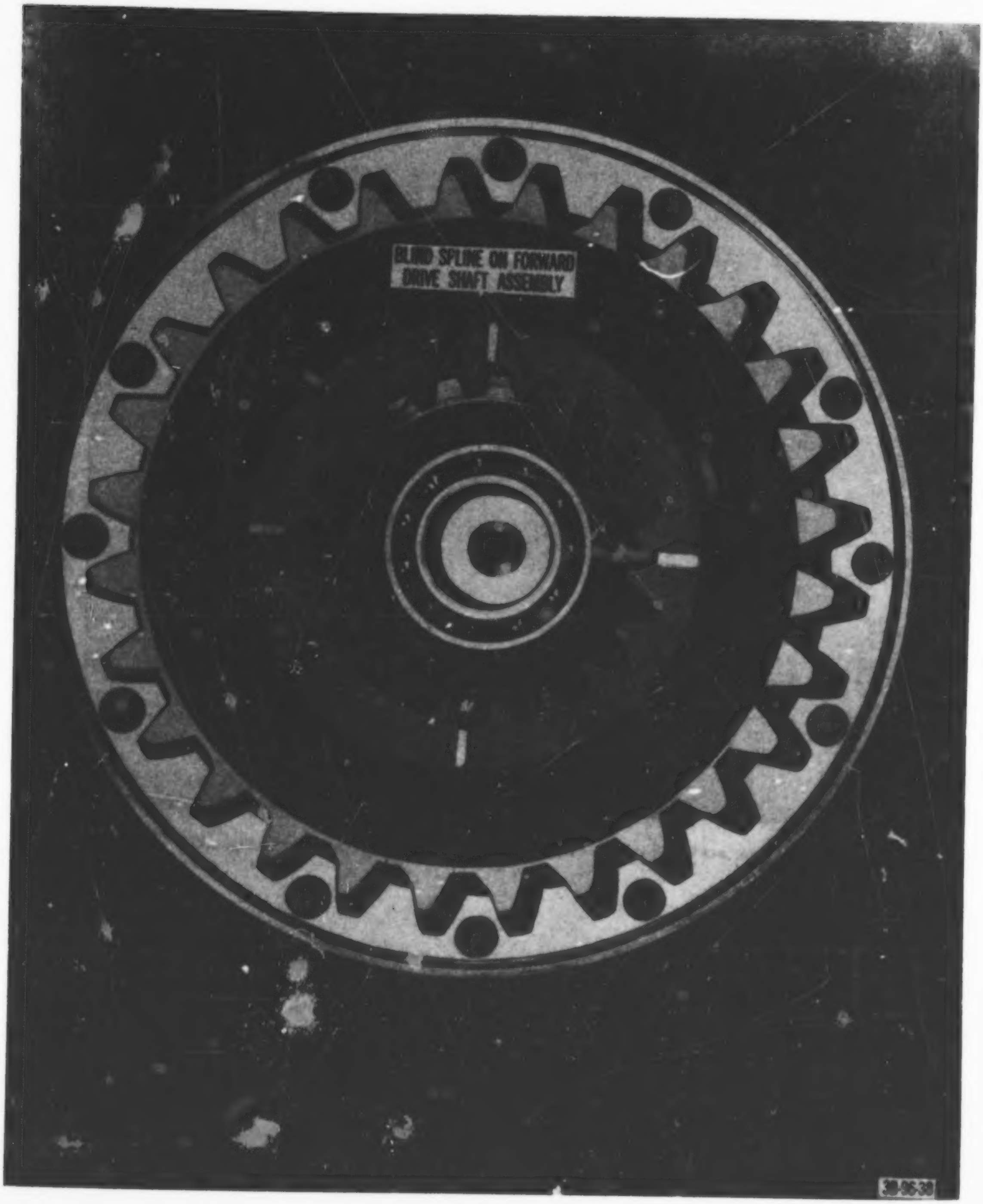

BLIND SPLINE ON FORWARD
DRIVE SHAFT ASSEMBLY

Figure 50. Friction disks alined with the blind spline on the forward drive shaft assembly.

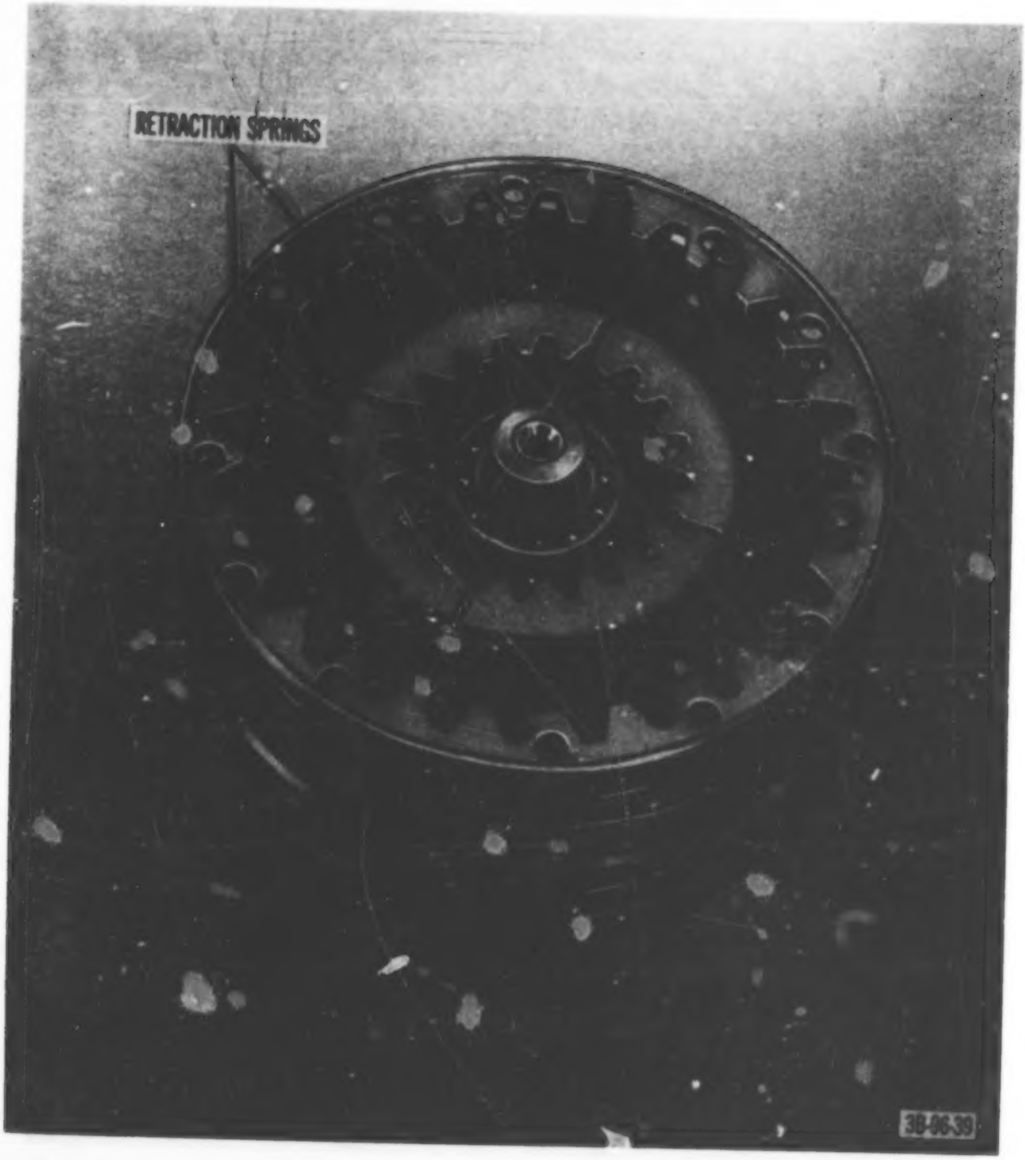

RETRACTION SPRINGS
38-96-39

Figure 51. Retraction springs installed in slots of clutch ring.

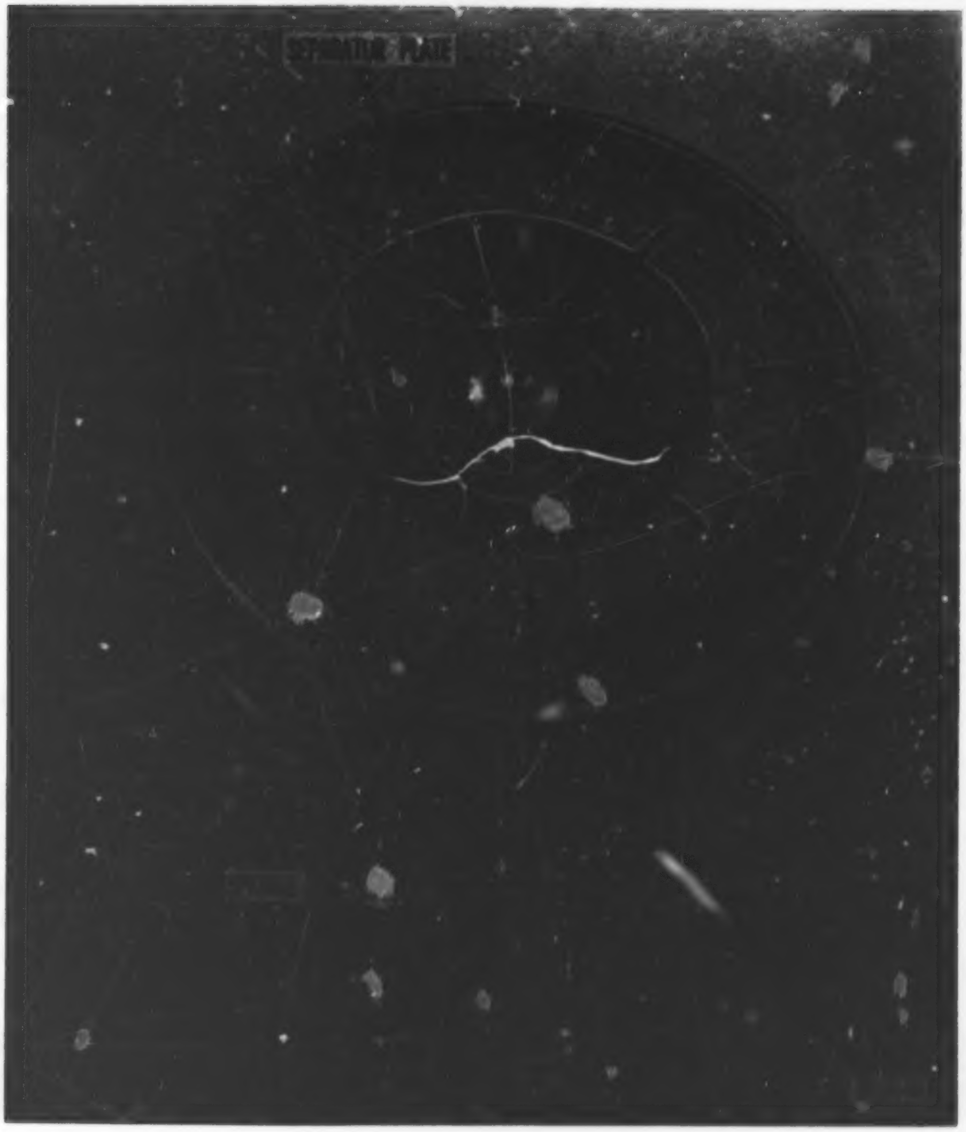

SEPARATOR PLATE

Figure 52. Sixth separator plate resting on retraction springs.

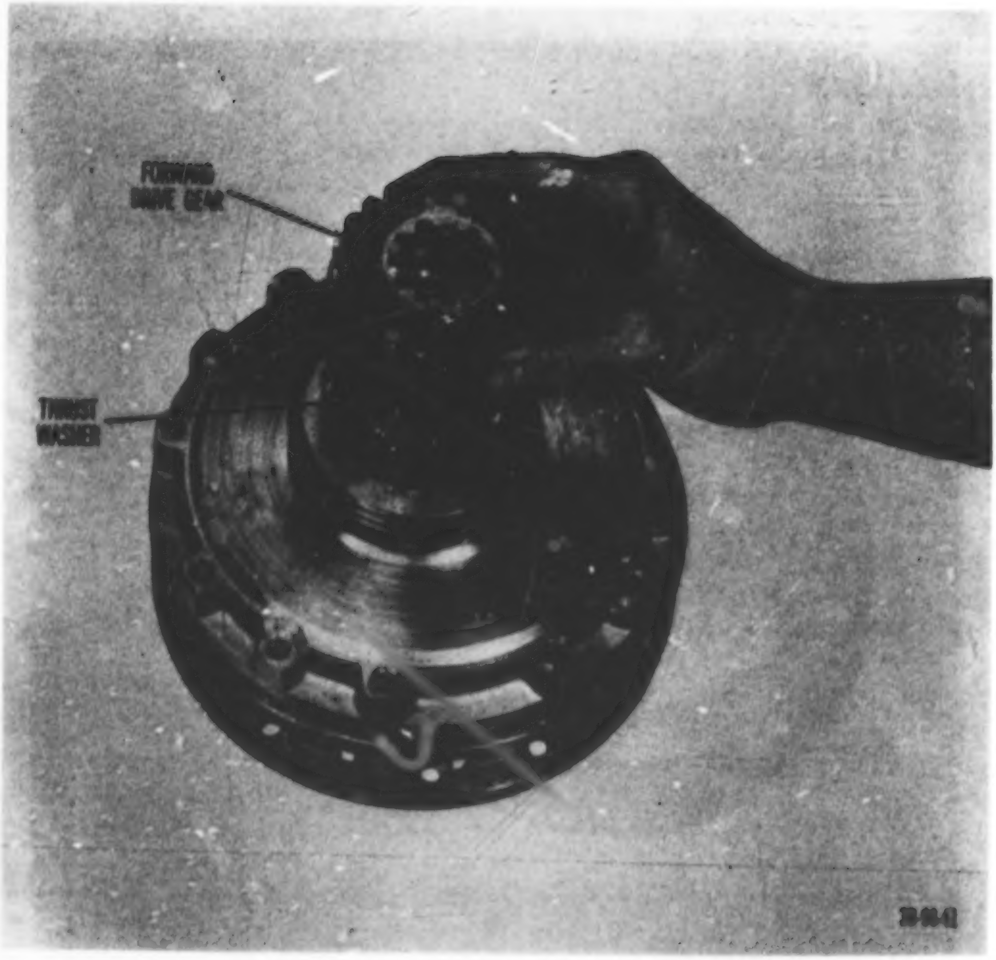

FORWARD DRIVE GEAR
THRUST WASHER

Figure 53. Installing forward drive gear on gear assembly.

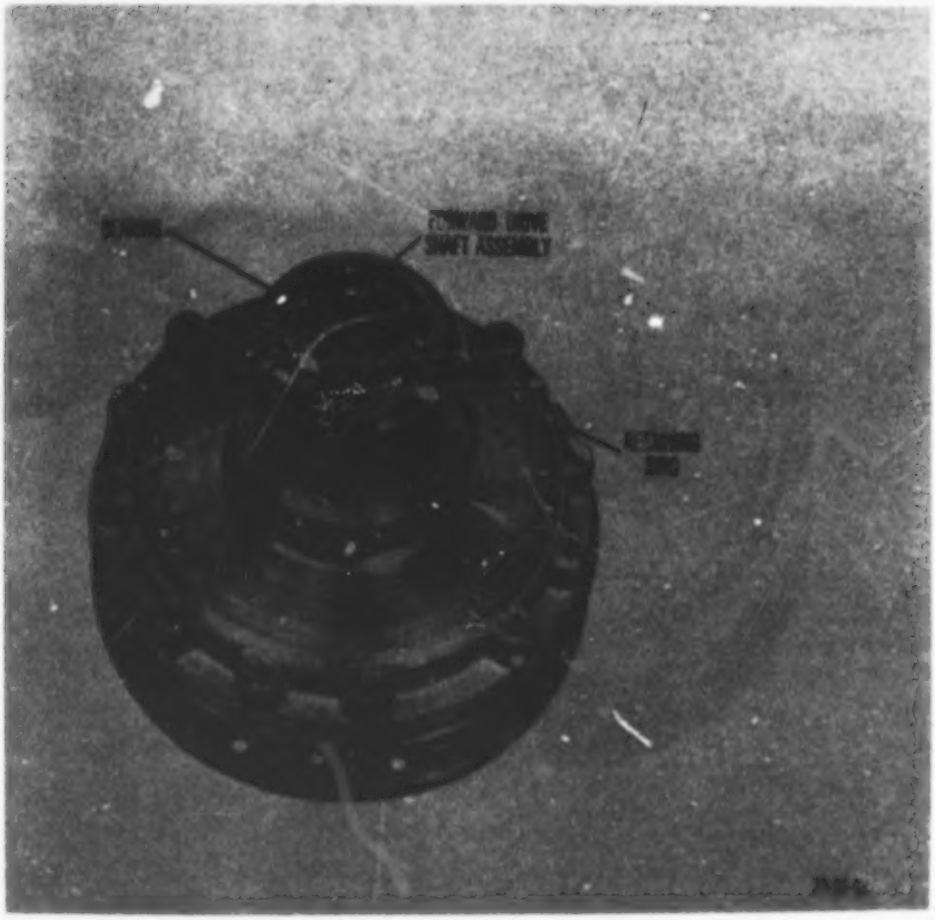

BEARING
FORWARD DRIVE SHAFT ASSEMBLY
RETAINING RING

Figure 54. Bearing and retaining ring installed on forward drive shaft.

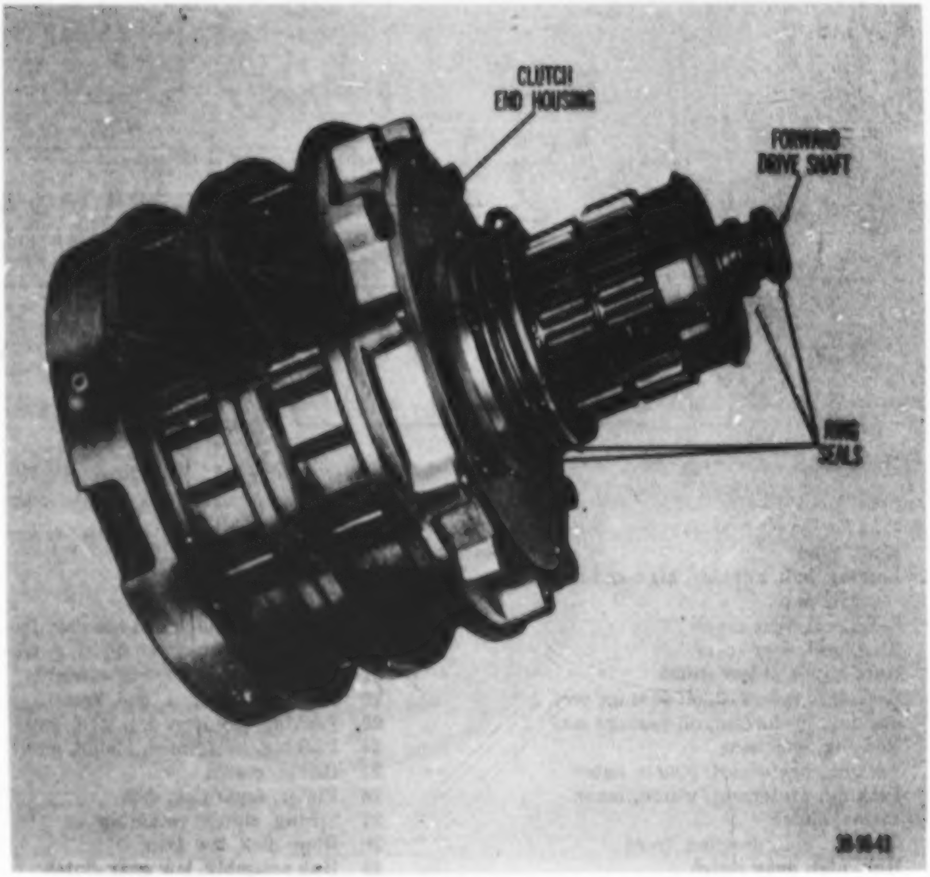
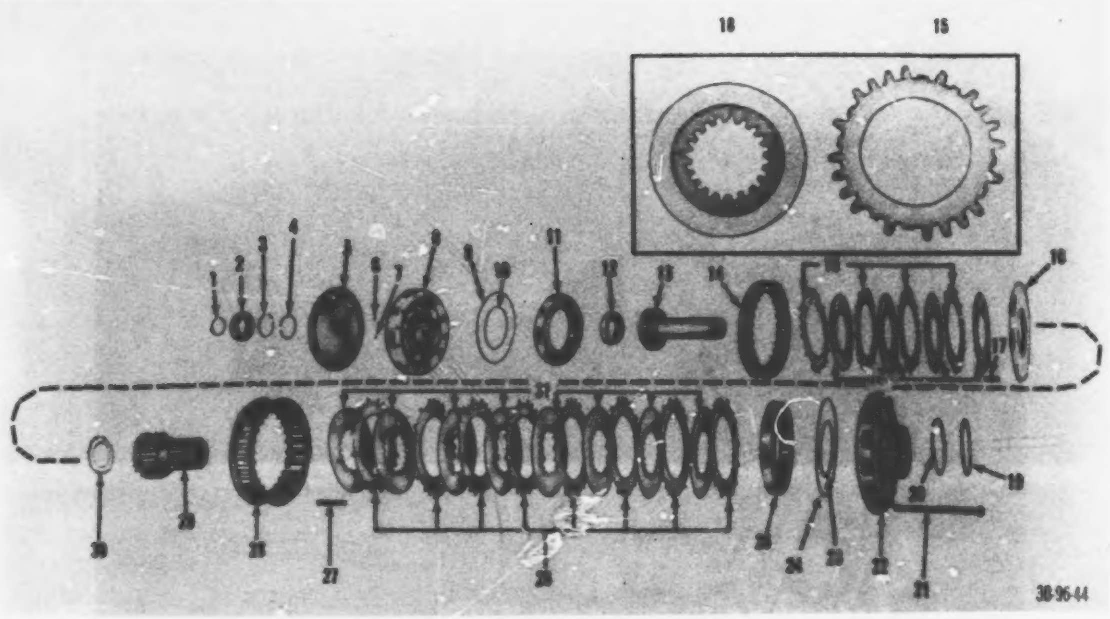

CLUTCH
END HOUSING
FORWARD
DRIVE SHAFT
RING
SEALS
38-16-43

Figure 55. Ring seals installed on forward-and-reverse clutch assembly and forward drive shaft.



1 Ring, snap
2 Bearing, ball, annular, high-and-law clutch shaft, rear
3 Ring, seal, rear cover
4 Ring, seal, rear cover
5 Hub, high-and-low clutch
6 Packing, preformed, oil passage seal
7 Packing, preformed, oil passage seal
8 Housing, end, rear
9 Packing, preformed, piston, outer
10 Packing, preformed, piston, inner
11 Piston, clutch
12 Bearing, ball, annular, front
13 Hub, high gear clutch
14 Ring, disk, high gear
15 Plates, separator, disk
16 Plate, separator, ring
17 Spring, piston, outer
18 Disks, friction
19 Ring, seal, clutch end housing, front
20 Ring, seal, clutch end housing, front
21 Screw, through, clutch assembly
22 Housing assembly, end, front
23 Packing, preformed, piston, inner
24 Packing, preformed, piston, outer
25 Piston, clutch
26 Plates, separator, disk
27 Spring, clutch, retaining
28 Ring, disk, low gear
29 Hub assembly, low gear clutch
30 Washer, thrust, high gear hub
31 Disks, friction

Figure 56. High-and-low clutch assembly, exploded view.

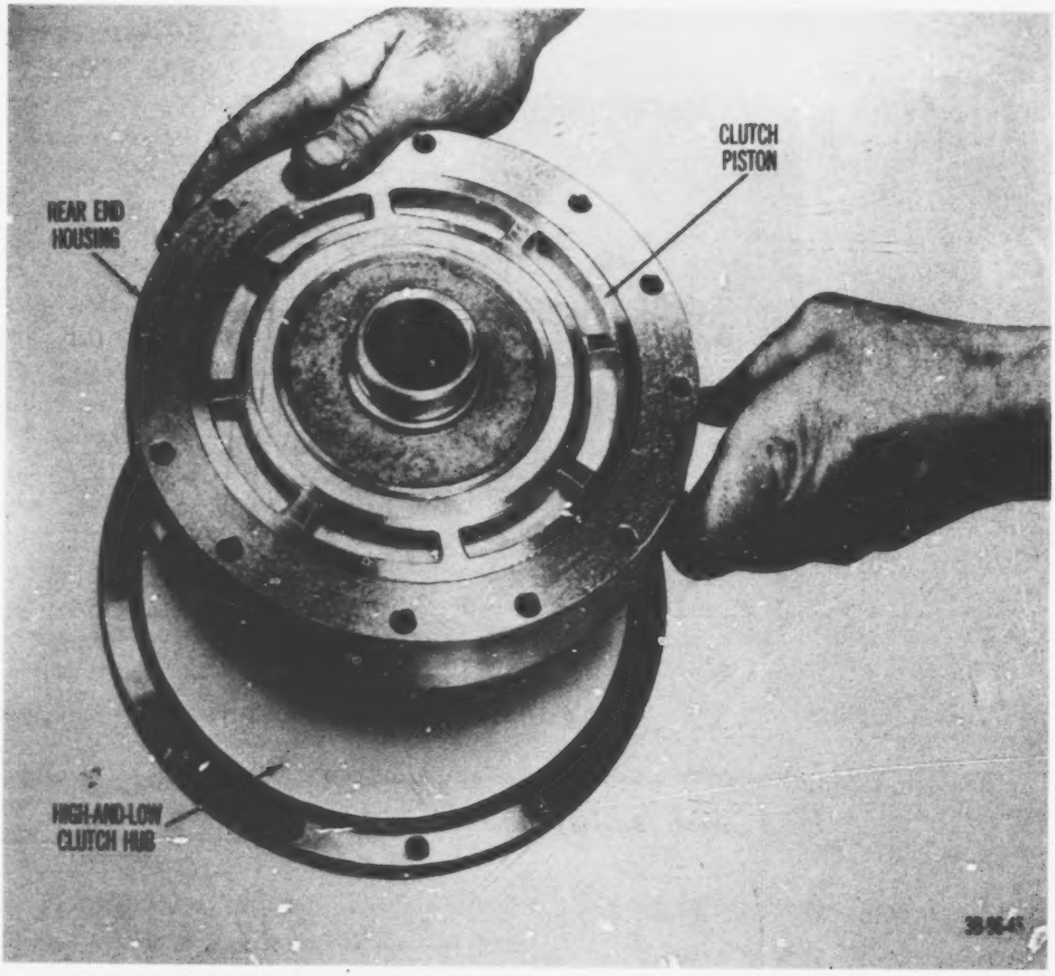

CLUTCH PISTON
REAR END HOUSING
HIGH-AND-LOW CLUTCH HUB
38-96-45

Figure 57. Installing rear end housing on clutch hub.

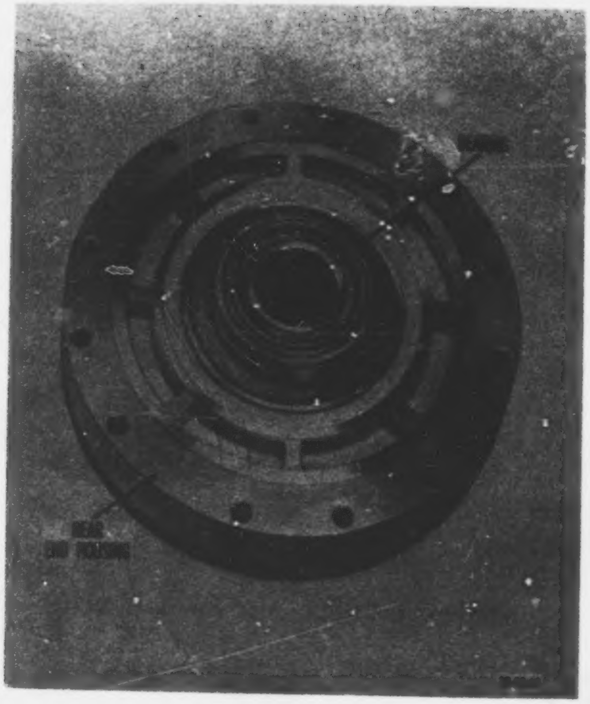

REAR
END HOUSING

Figure 58. Bearing installed on rear end housing.

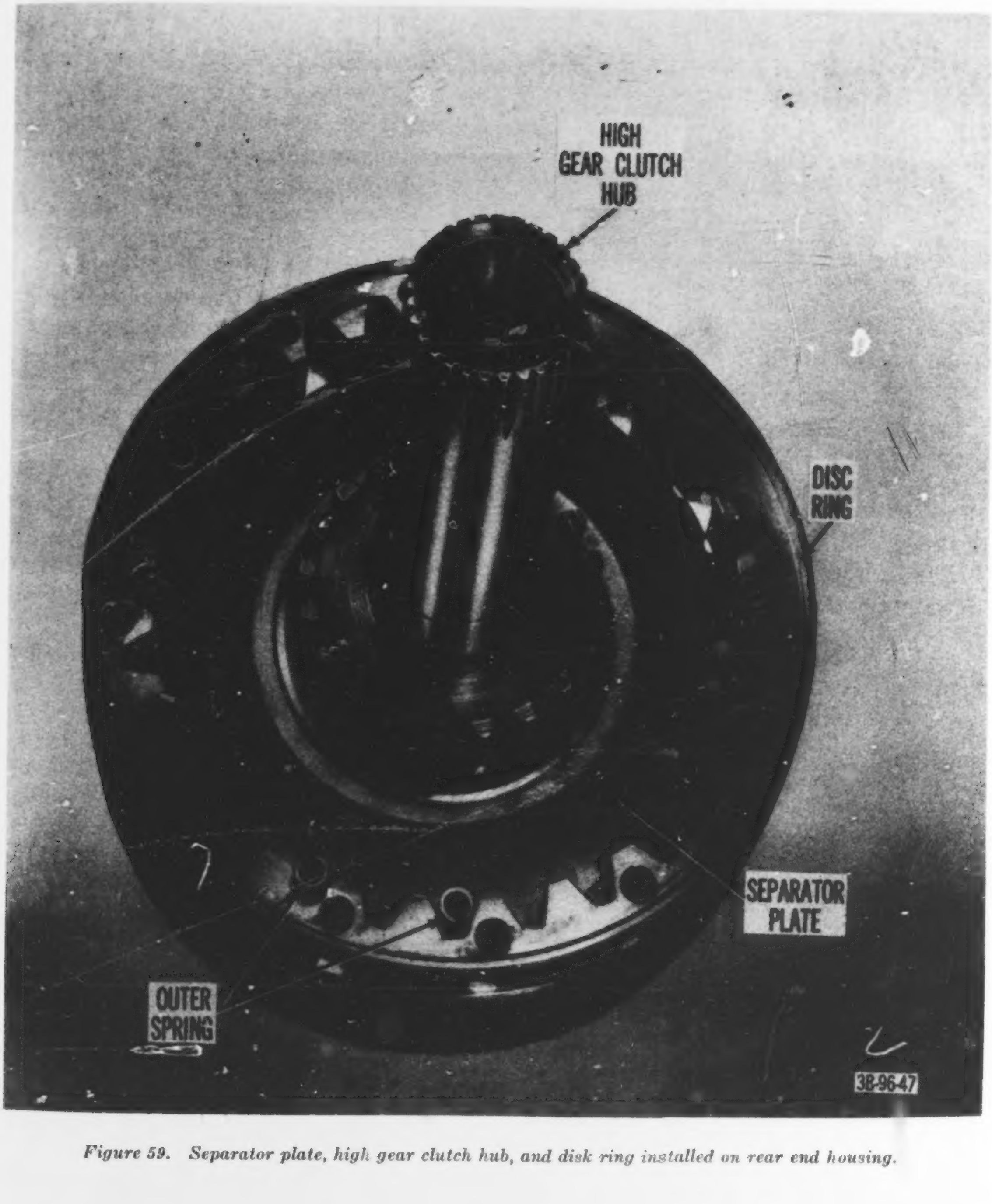

HIGH
GEAR CLUTCH
HUB
DISC
RING
SEPARATOR
PLATE
OUTER
SPRING
3B-96-47

Figure 59. Separator plate, high gear clutch hub, and disk ring installed on rear end housing.

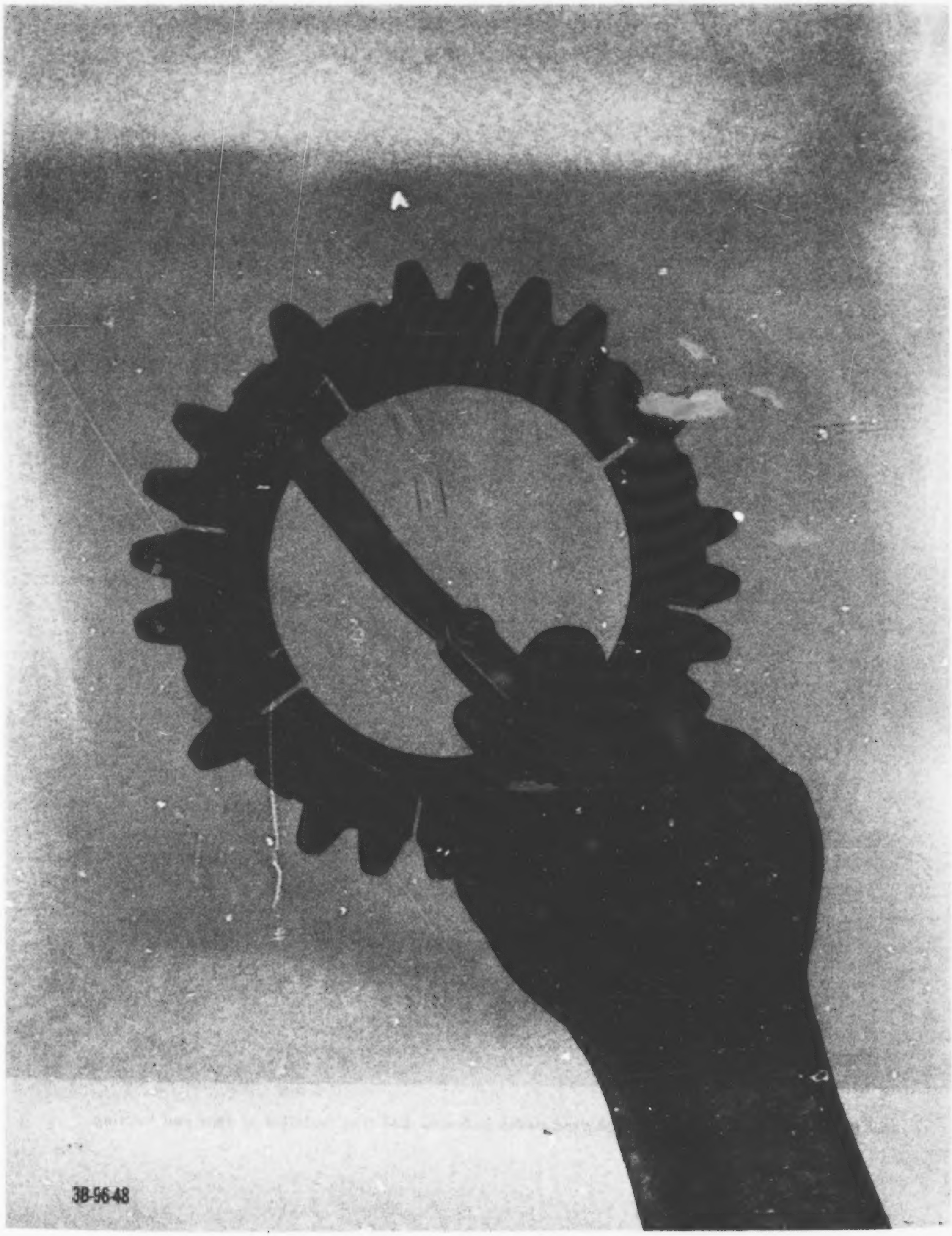


Figure 60. Checking for "dishing" of separator plates of high-and-low clutch assembly.

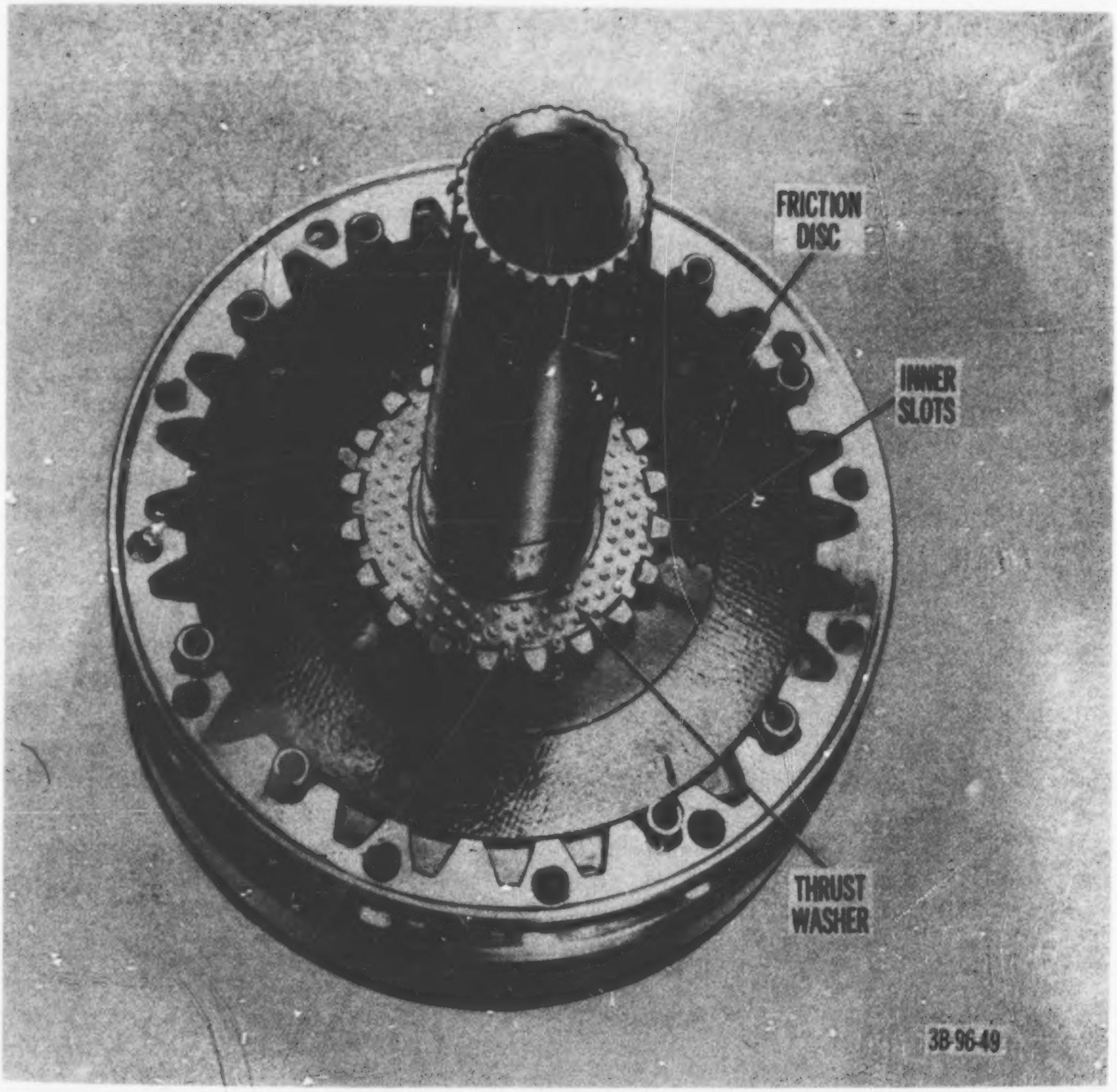

FRICTION DISC
INNER SLOTS
THRUST WASHER
3B-96-49

Figure 61. Friction disk installed and alined.

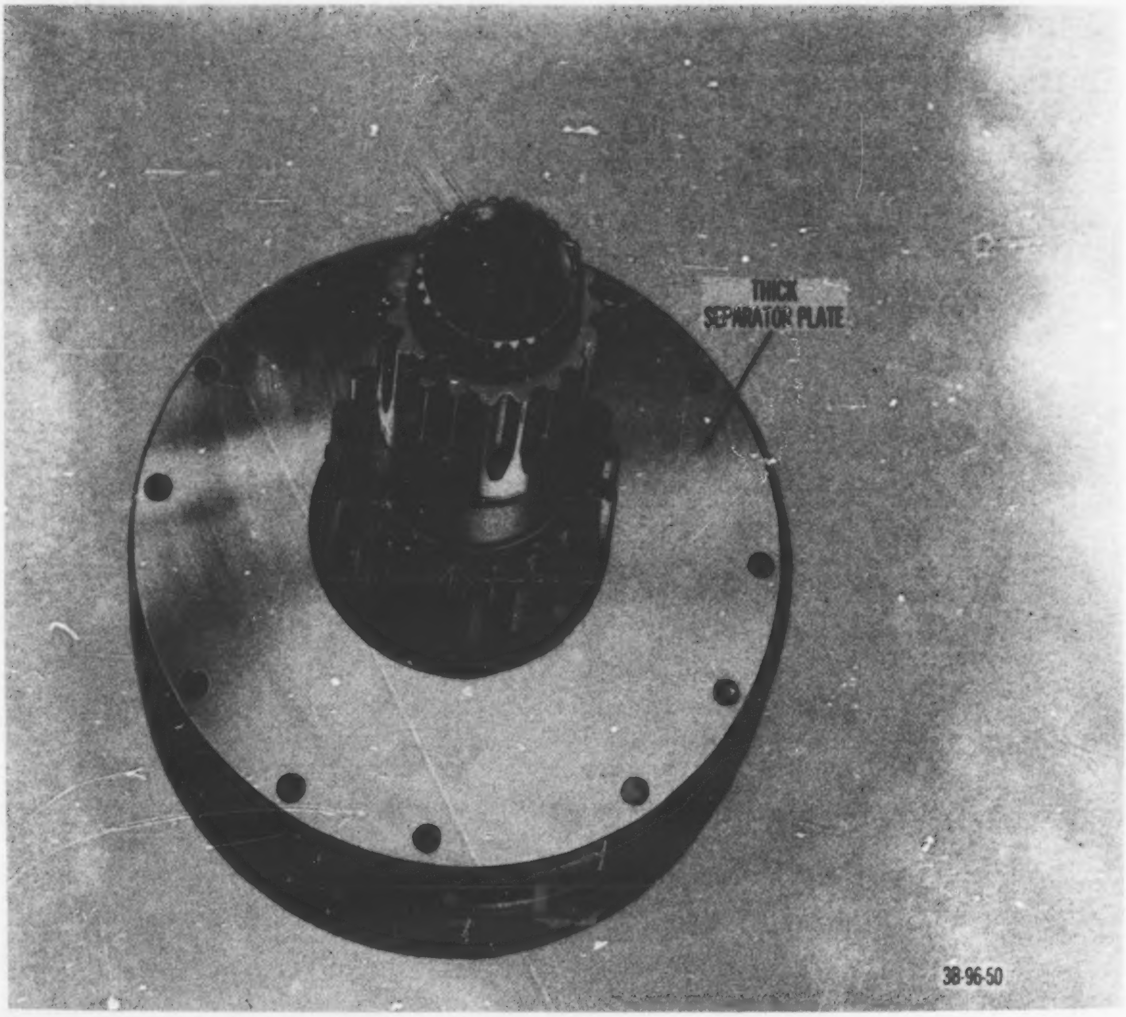

THICK SEPARATOR PLATE
38-96-50

Figure 62. Thick separator plate installed on high gear clutch hub.

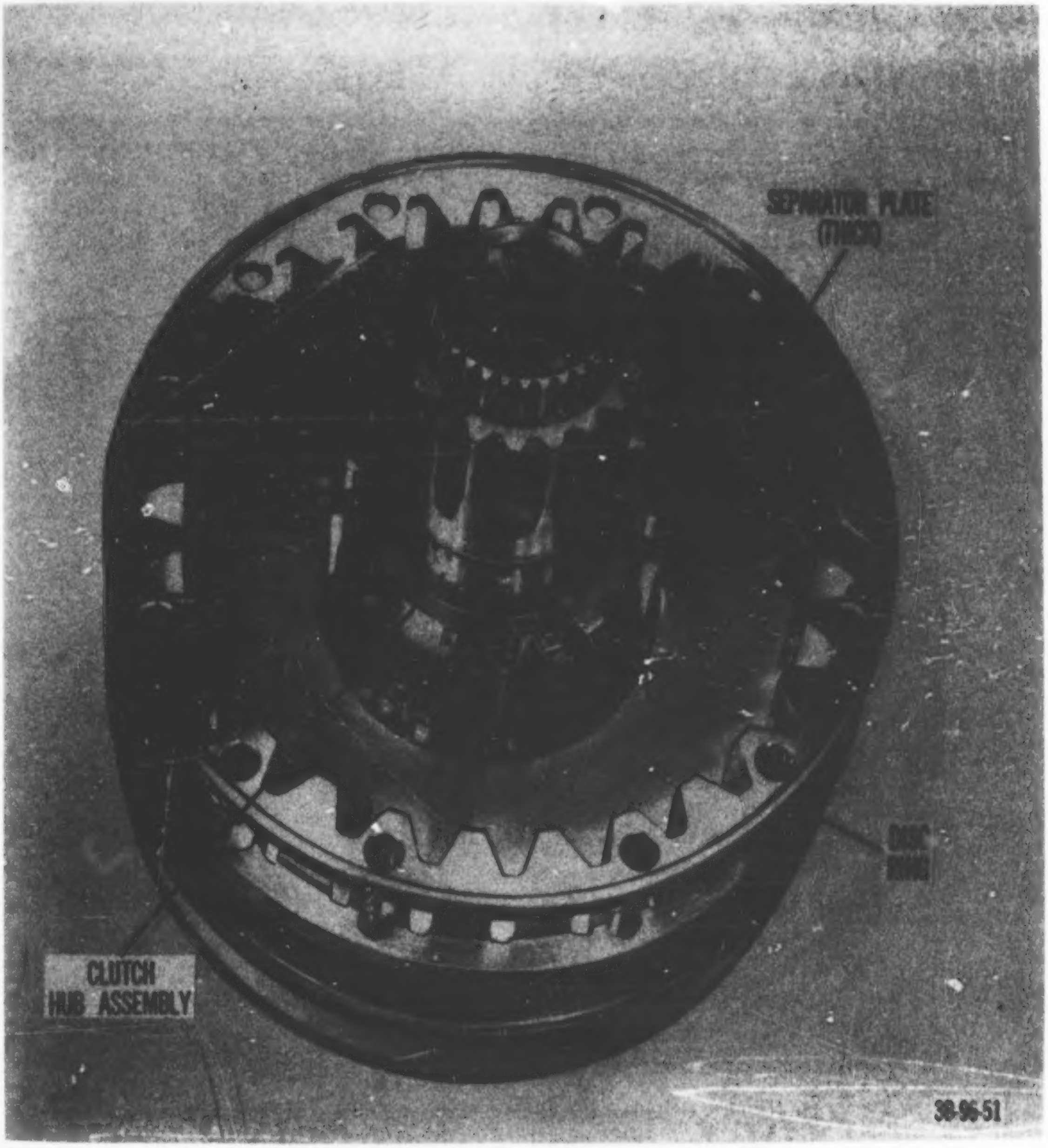

SEPARATOR PLATE (THICK)
DISC RING
CLUTCH HUB ASSEMBLY
38-96-51

Figure 63. Disk ring installed on high gear clutch hub.

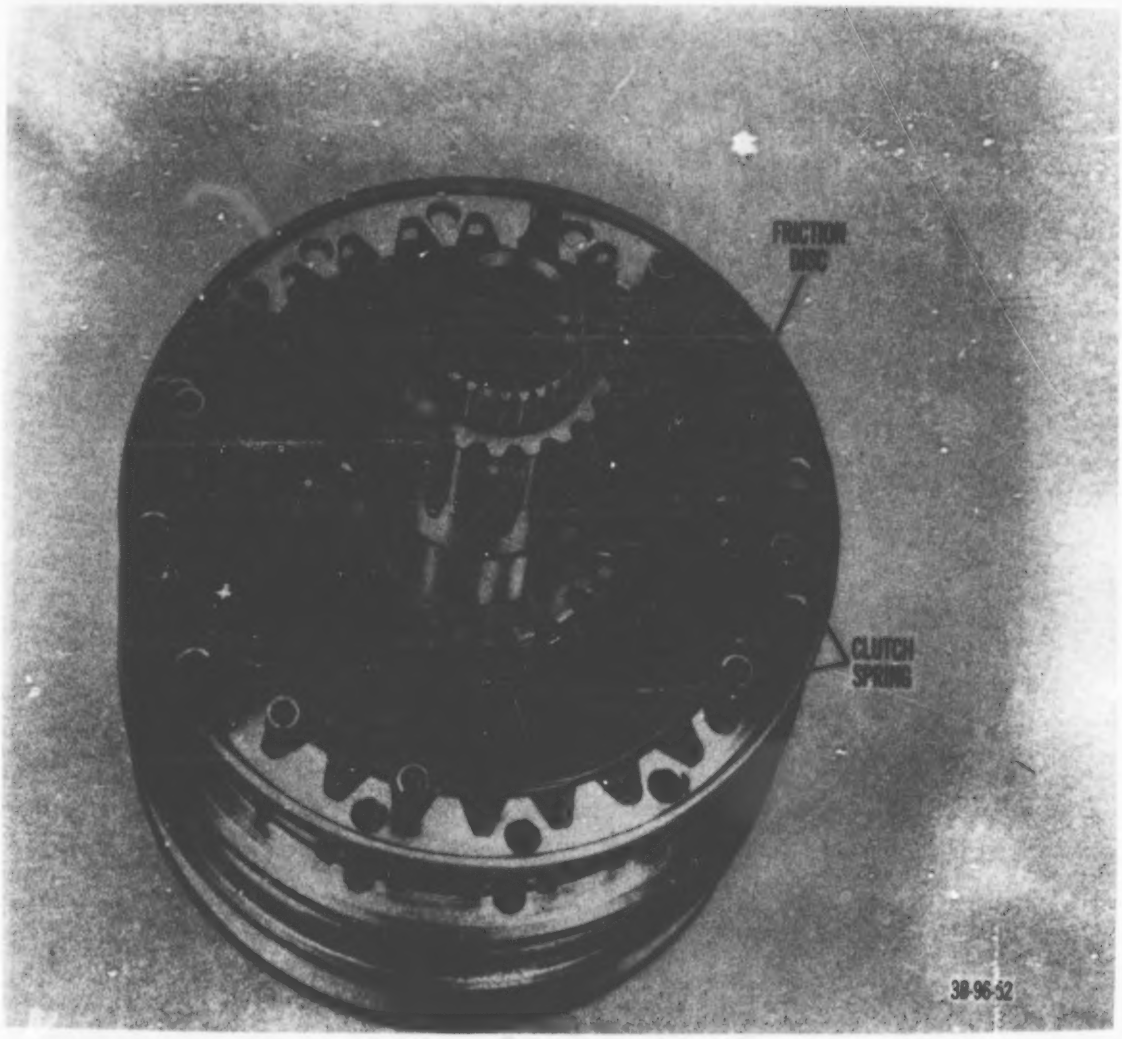

FRICTION DISC
CLUTCH SPRING
38-96-52

Figure 64. Friction disk and clutch springs installed on high gear clutch hub.

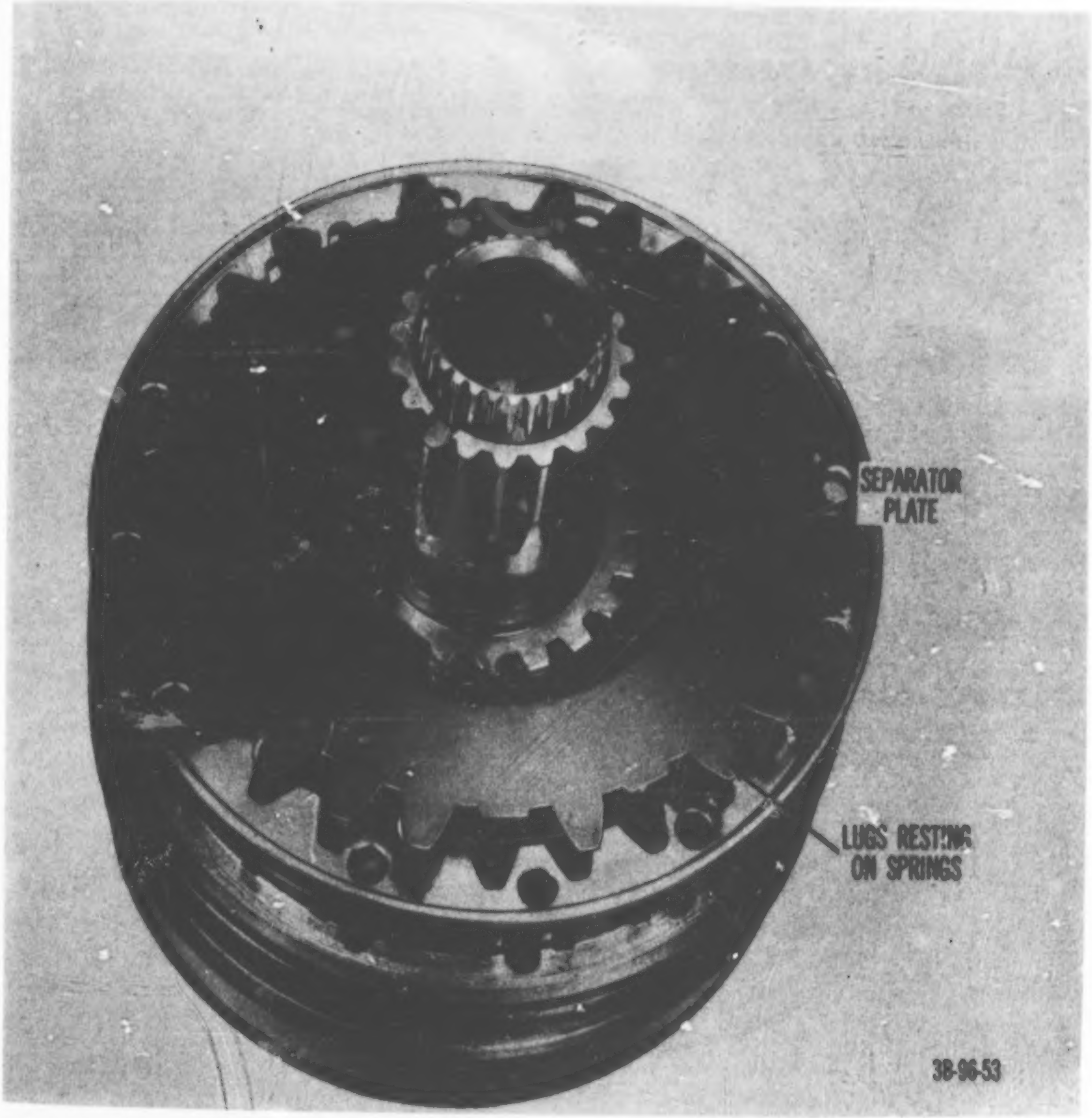

SEPARATOR PLATE
LUGS RESTING ON SPRINGS
38-96-53

Figure 65. Separator plate with lugs resting on springs.

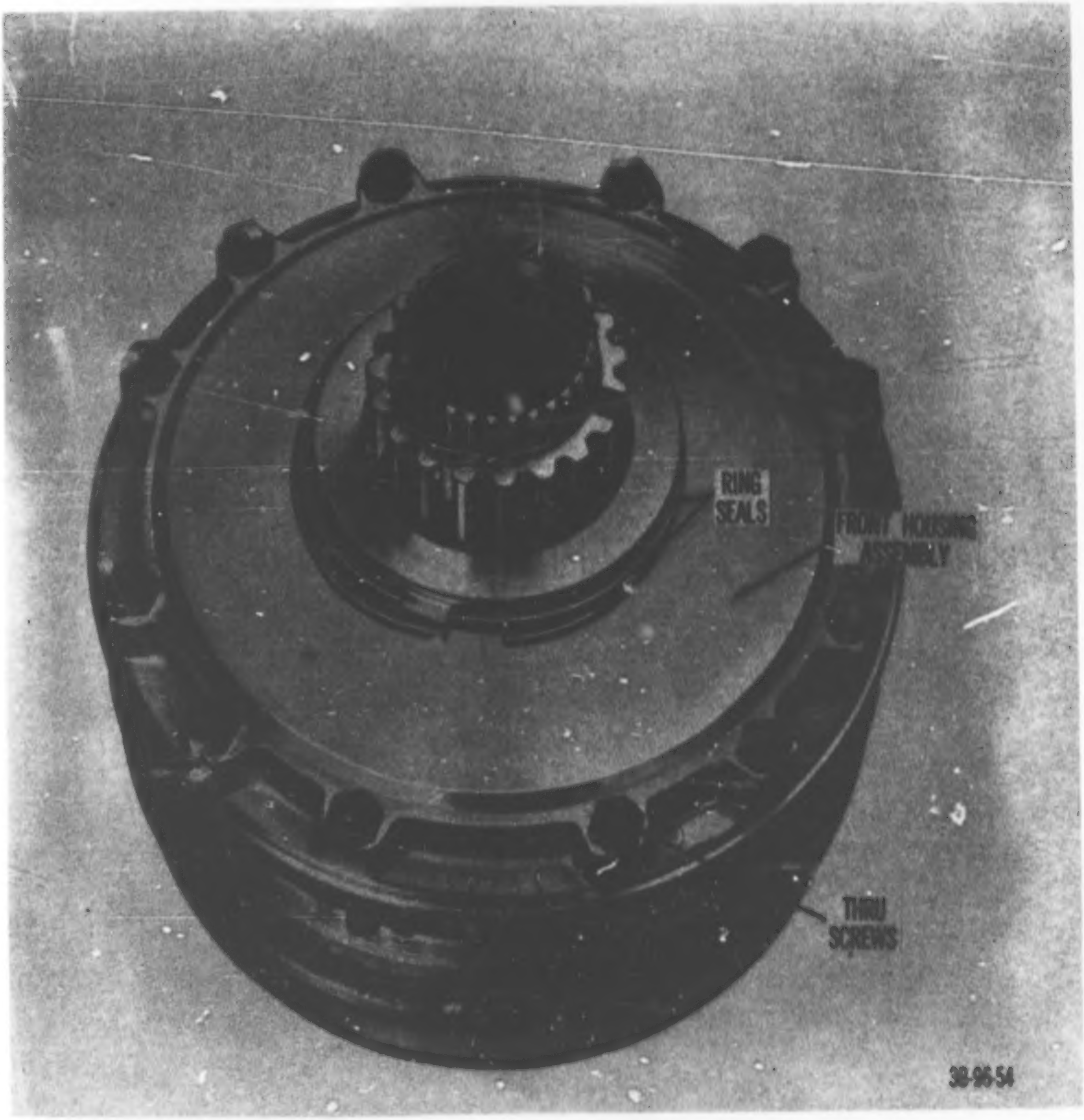

RING SEALS
FRONT HOUSING ASSEMBLY
THRU SCREWS
38-96-54

Figure 66. High-and-low clutch assembled.

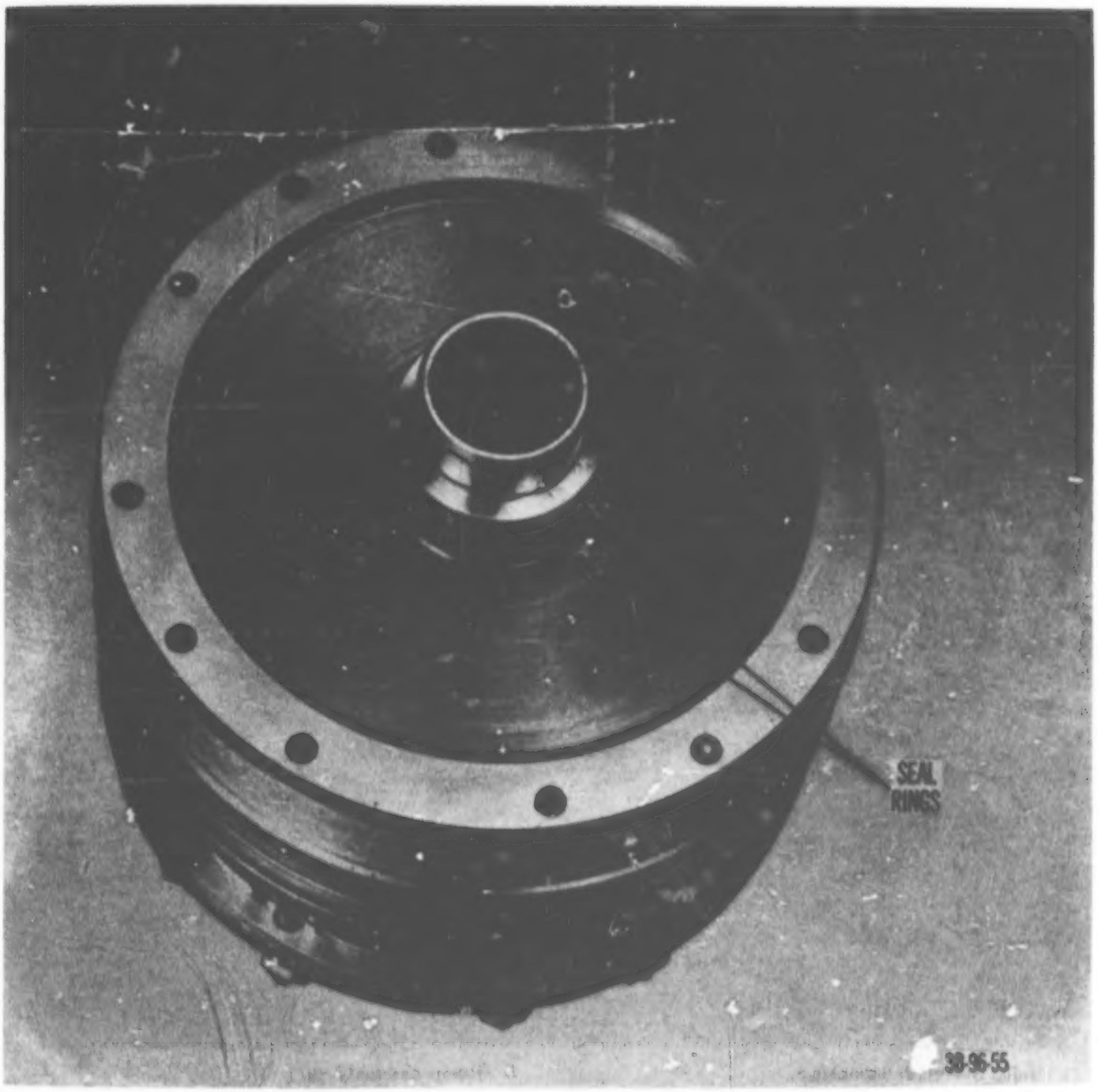
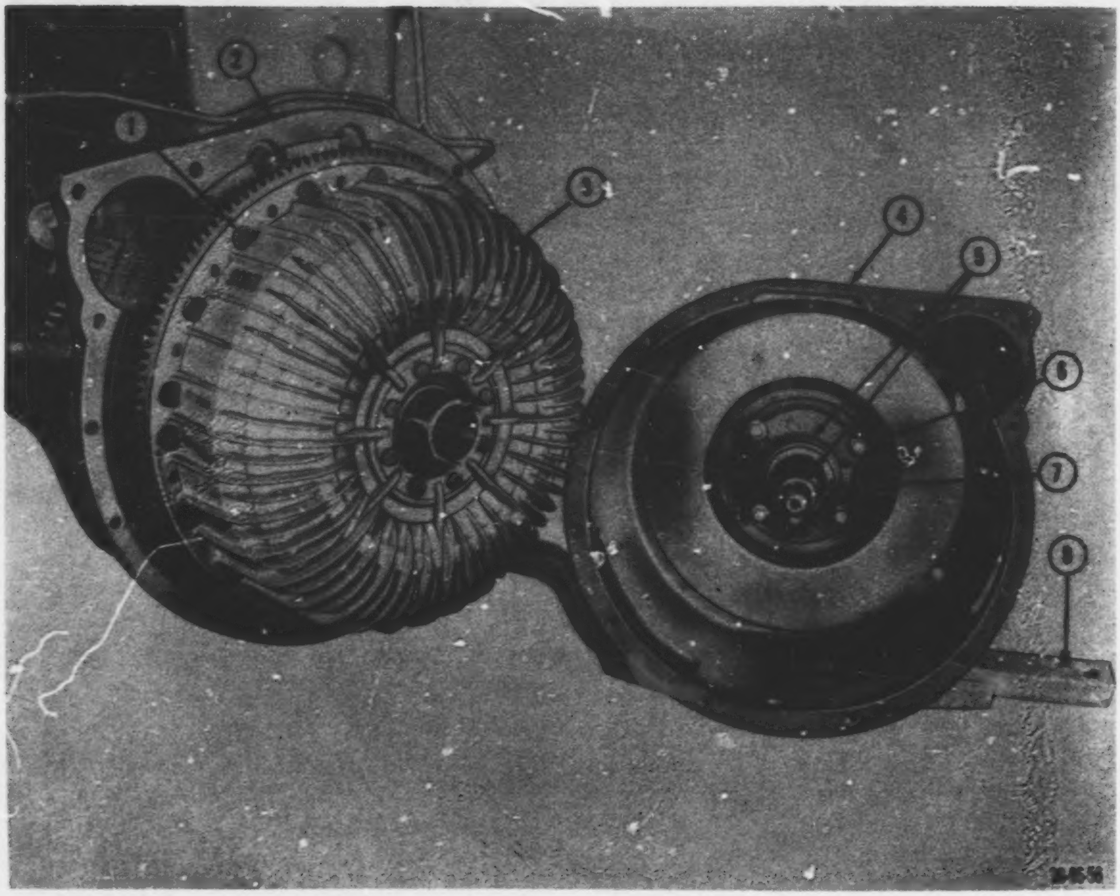

SEAL RINGS
38-96-55

Figure 67. Seal rings installed on high-and-low clutch hub.



1 Bolt, converter mounting
2 Plate, adapter, converter housing-to-cylinder block
3 Converter, torque, with ring gear
4 Housing, converter
5 Pump assembly, oil
6 Bolt, pump mounting
7 Seal, oil
8 Mount, engine

Figure 68. Torque converter with housing removed.

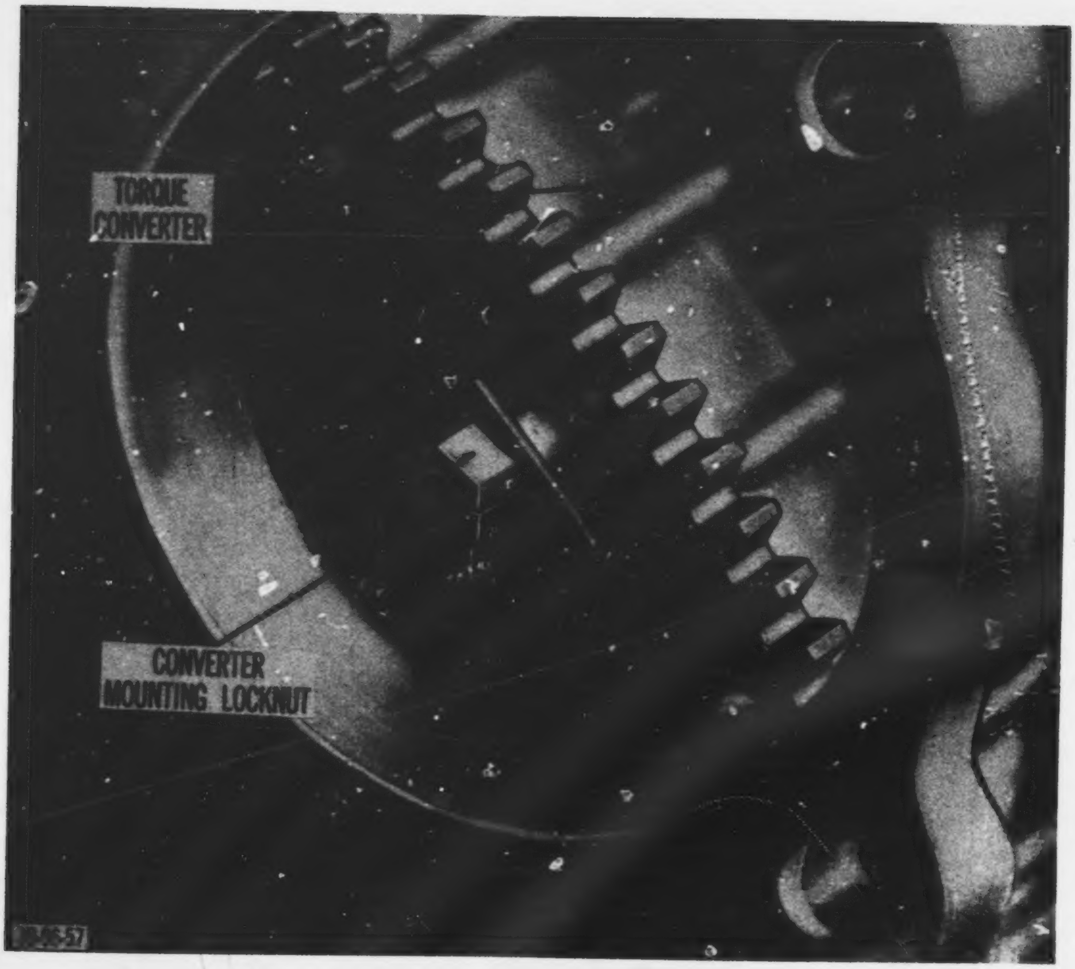

TORQUE CONVERTER
CONVERTER MOUNTING LOCKNUT

Figure 69. Mounting locknut on torque converter, viewed through starter opening.

best copy available

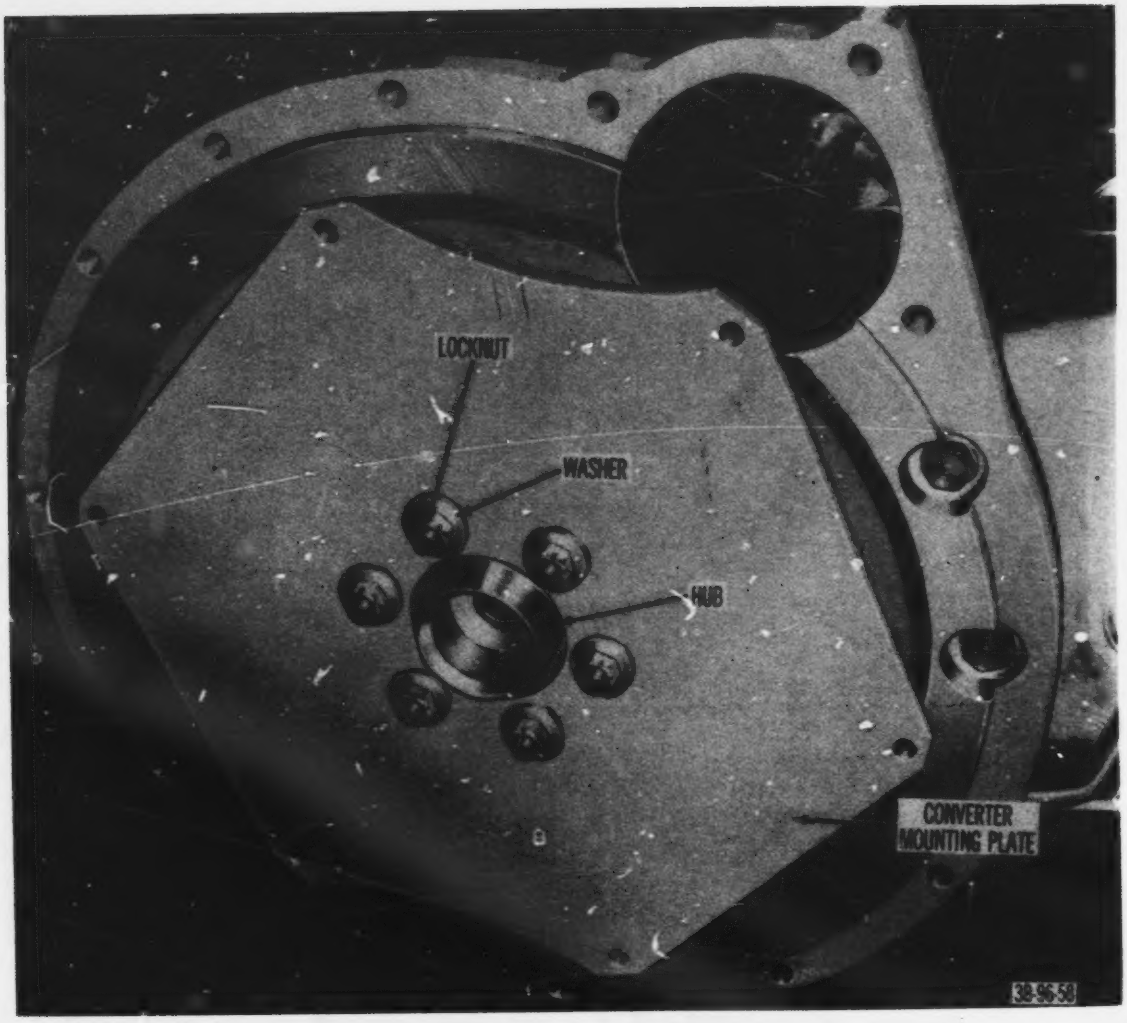
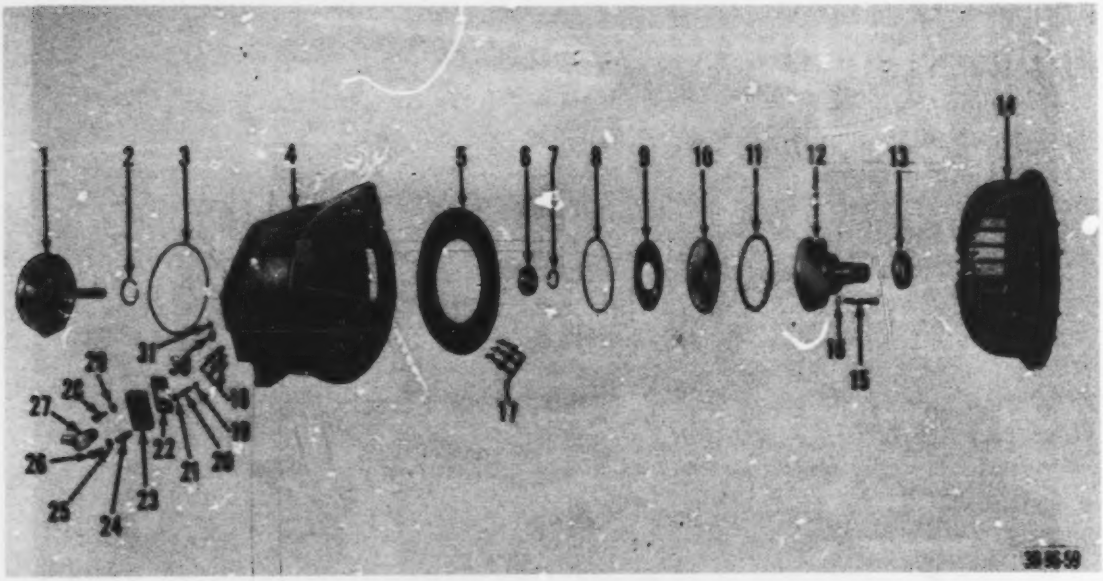

LOCKNUT
WASHER
HUB
CONVERTER MOUNTING PLATE
38-96-58

Figure 70. Torque converter mounting plate and hub.



1 Shaft, main
2 Seal, ring, shaft
3 Packing, preformed, pump-to-converter
4 Housing, converter
5 Plate, baffle, converter housing
6 Bearing, ball, main shaft
7 Ring, retaining, main shaft bearing
8 Packing, preformed, pump-to-housing
9 Gasket, pump adapter
10 Plate, adapter-to-housing
11 Gasket, pump, front
12 Pump assembly
13 Seal, oil
14 Converter, torque, with ring gear
15 Bolt, machine
16 Washer, flat
17 Screws, drive
18 Plugs, pipe, rear housing cover
19 Ball, bearing, pump inlet oil pressure regulator
20 Spring, compression, pressure regulator
21 Seat, spring, pressure regulator
22 Gasket, adapter-to-housing
23 Plate, adapter, pump inlet, control valve mounting
24 Fitting, pipe
25 Lockwasher
26 Capscrew
27 Fitting, elbow
28 Capscrew
29 Lockwasher
30 Packing, preformed, housing oil port, lower
31 Packing, preformed, housing oil port, upper

Figure 71. Torque converter, exploded view.

TRANSMISSION CONTROL VALVE
MOUNTING SCREWS

Figure 72. Transmission control valve mounted on transmission case.

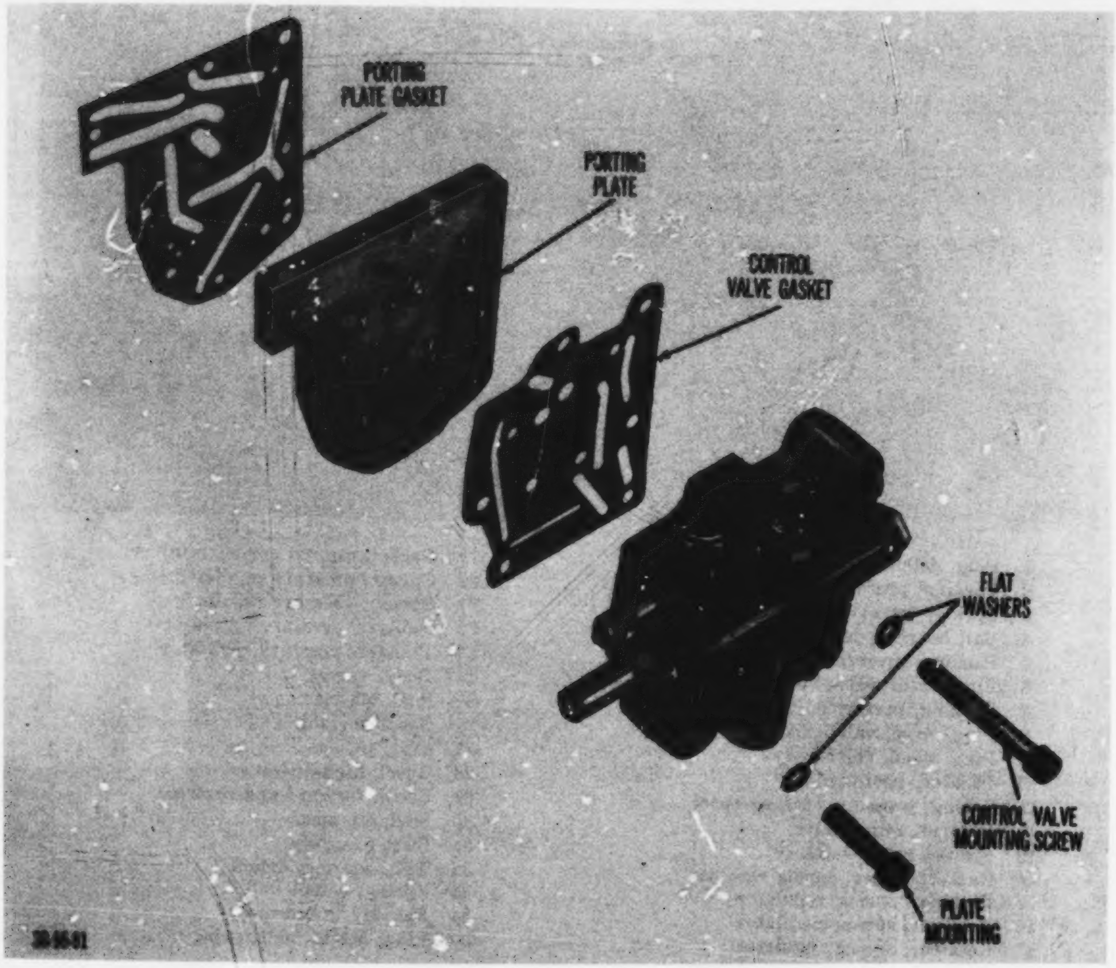
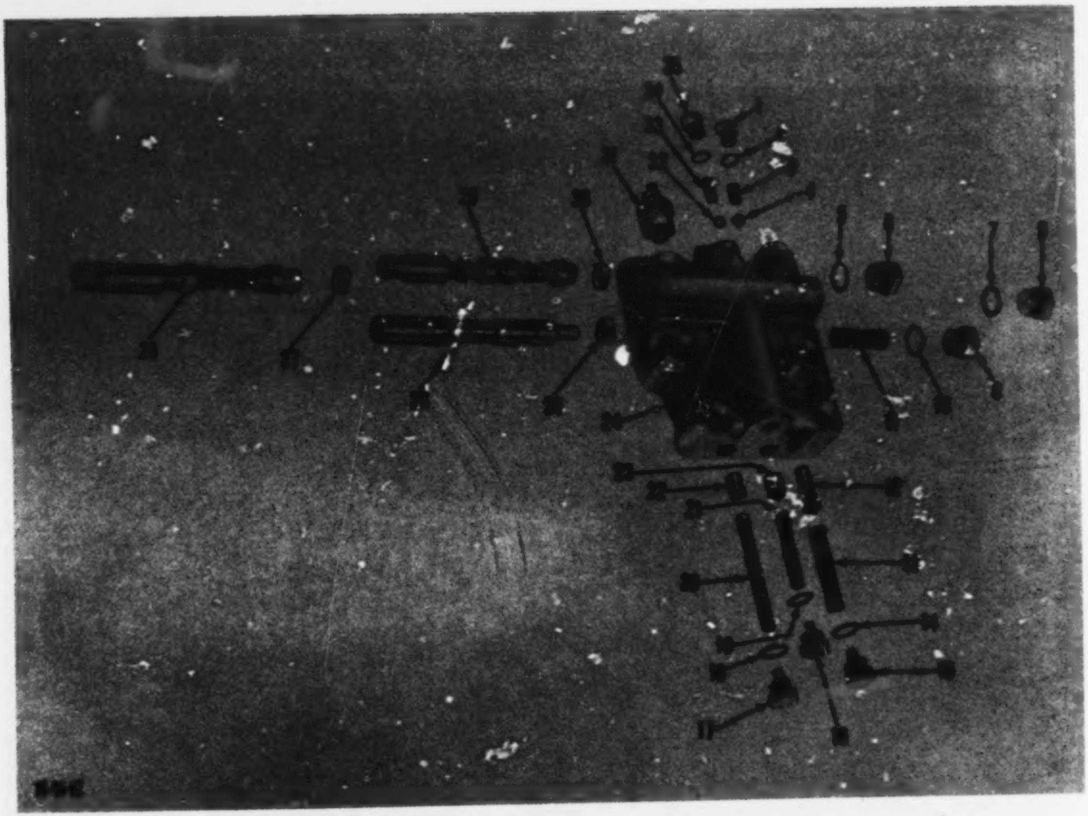

PORTING PLATE GASKET
PORTING PLATE
CONTROL VALVE GASKET
FLAT WASHERS
CONTROL VALVE MOUNTING SCREW
PLATE MOUNTING

Figure 73. Transmission control valve and attaching parts.



1	Plug, detent, ball spring
2	Packing, preformed
3	Spring, detent ball
4	Ball bearing, detent
5	Packing, preformed
6	Plug, spool, valve body
7	Packing, preformed
8	Plug, spool, valve body
9	Plug, spool, valve body
10	Packing, preformed
11	Spring, pressure, inching spool
12	Plunger, relief valve
13	Spring, relief valve
14	Gasket, copper, spring retainer
15	Retainer, spring regulator
16	Retainer, spring regulator
17	Retainer, spring regulator
18	Gasket, copper, spring retainer
19	Gasket, copper, spring retainer
20	Spring, pressure regulator
21	Spring, pressure regulator
22	Plunger, pressure regulator
23	Plunger, pressure regulator
24	Body, valve
25	Seal, oil, spool
26	Spool, inching
27	Seal, oil, spool
28	Spool, high-and-low
29	Spool, forward-and-reverse
30	Seal, oil, spool
31	Switch, safety
32	Ball, bearing, detent
33	Spring, detent ball
34	Packing, preformed
35	Plug, detent, ball spring

Figure 74. Transmission control valve, exploded view.

Section VII. PROPELLER SHAFT (GROUP 09) AND STEERING AXLE (GROUP 10)

45. Drive Shaft

a. Removal and Disassembly.

(1) Remove screws (1, fig. 75) and lock plates (2) that secure shaft (5) to the differential yoke fitting (3) and the transmission yoke fitting (6).

(2) Remove the shaft and the yokes from the truck.

(3) Remove screws (8) and lock plates (9) that secure universal joints (4) to shaft and separate shaft and bearing assemblies.

b. Inspection. Inspect universal joints for wear and cracks.

c. Assembly and Installation. Reverse procedures in *a* above.

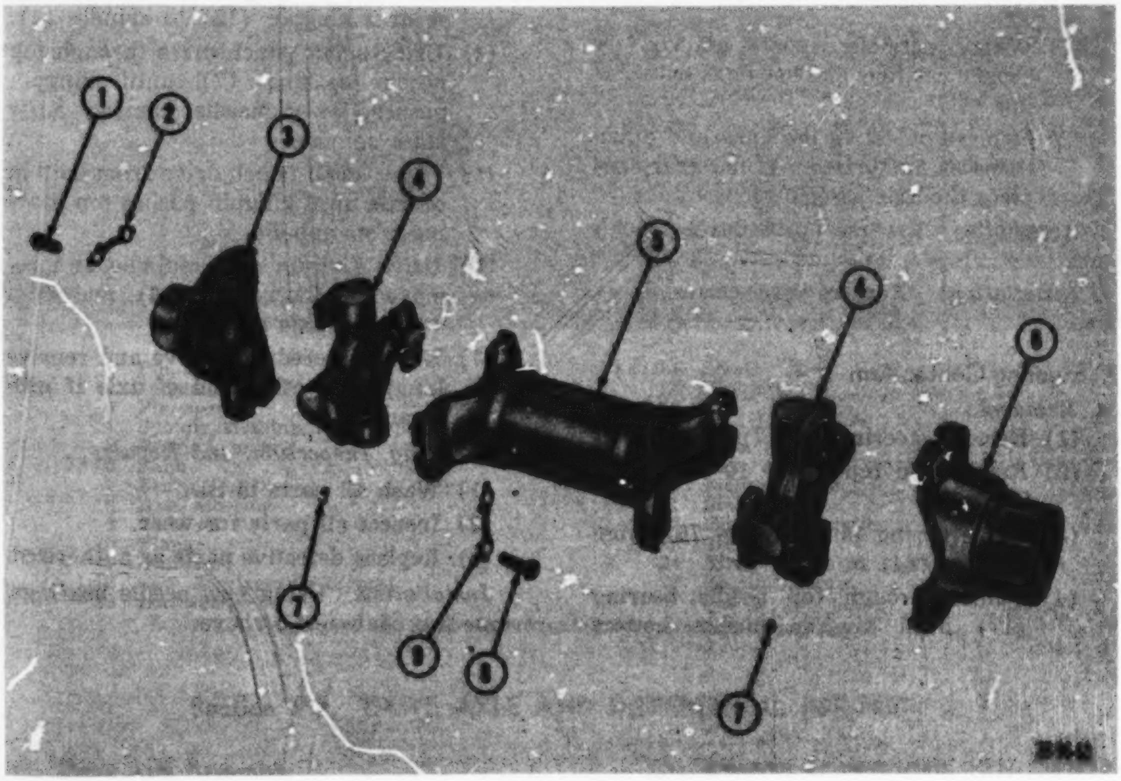
46. Steering Axle Assembly

a. Removal.

(1) Raise rear of truck with a suitable hoist and place blocks under counterweight and frame.

(2) Remove steering wheels (TM 10-3930-222-20).

(3) Place jack under center of steering axle.



1 Screw
2 Plate, lock
3 Fitting, yoke
4 Universal joints, cross and bearing assemblies
5 Shaft
6 Fitting, yoke
7 Fittings, lubrication
8 Screw
9 Plate, lock

Figure 75. Drive shaft, exploded view.

(4) Remove cotter pin, grease fitting, and end plug, and disconnect power steering cylinder (TM 10-3930-222-20).

(5) Remove cotter pin, end plug, seat and spring, and disconnect drag link (TM 10-3930-222-20).

(6) Mark axle support caps (12, fig. 76) and remove four screws (14) and lockwashers (13).

(7) Lower jack slightly, remove two support caps, and remove steering axle assembly.

b. Disassembly.

(1) Remove tie rods (TM 10-3930-222-20).

(2) Remove kingpins (par. 48).

(3) Remove steering center arm (par. 47).

c. Inspection. Inspect all parts for excessive wear, cracks, breaks, binds, and mutilations.

d. Repair.

(1) Where possible, repair cracked or broken castings and housings by welding.

(2) Replace defective bearings and other items as authorized. If necessary replace the axle assembly.

e. Assembly. Reverse procedures in *b* above.

f. Installation. Reverse procedures in *a* above.

47. Steering Center Arm

a. Removal.

(1) Remove steering axle (par. 46).

(2) Remove tie rods (TM 10-3930-222-20).

(3) Drive spring pin (21, fig. 76) from kingpin (24) in center arm.

(4) Punch through top needle bearing (17) until kingpin pushes bottom needle bearing (25) from center arm. Punch kingpin from bottom until top needle bearing is removed.

(5) Remove kingpin from center arm and remove center arm from truck.

b. Cleaning, Inspection, and Repair.

(1) Wash all parts in SD.

(2) Inspect all parts for wear.

(3) Replace defective parts as authorized.

c. Installation. Using new needle bearings, reverse procedures in *a* above.

48. Steering Spindles and Kingpins

a. Removal.

(1) Remove steering wheels (TM 10-3930-222-20).

(2) Disconnect tie rods from spindles (TM 10-3930-222-20).

(3) Remove spring pin (3, fig. 76) that secures kingpin (15) to spindle (4).

(4) Using small punch drive through top needle bearing (7) until kingpin pushes lower needle bearing (16) from spindle.

(5) Using small punch drive from bottom of axle until kingpin pushes top bearing from spindle.

(6) Drive kingpin from spindle and remove spindle, bearing (5), and shim (6) from axle assembly.

(7) Repeat procedures above and remove kingpin on other end of axle if necessary.

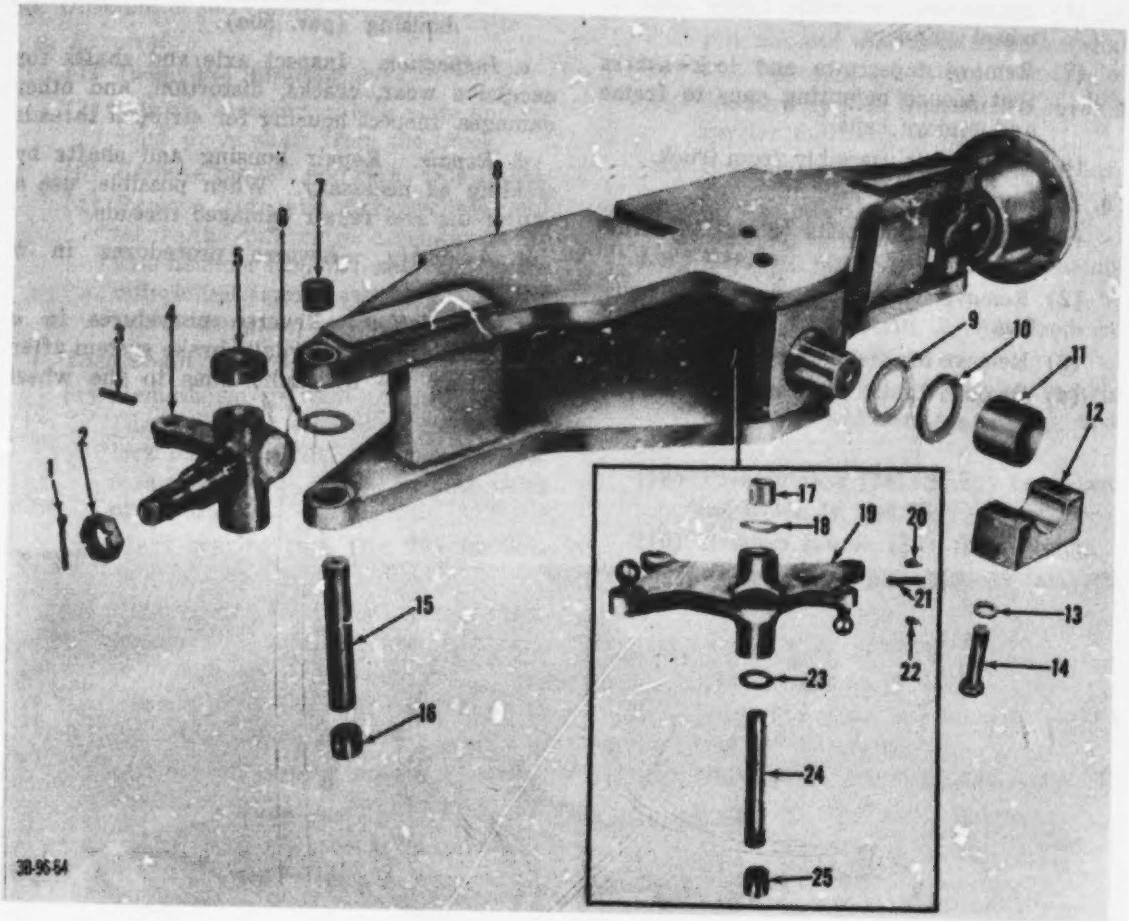
b. Cleaning, Inspection, and Repair.

(1) Wash all parts in SD.

(2) Inspect all parts for wear.

(3) Replace defective parts as authorized.

c. Installation. Using new needle bearings, reverse procedures in *a* above.



1 Pin, cotter
2 Jamnut, slotted
3 Pin, spring
4 Spindle, steering, right-hand
5 Bearing, roller
6 Shim
7 Bearing needle
8 Axle, steering
9 Shim set
10 Flange
11 Bushing
12 Cap, steering axle support
13 Lockwasher
14 Screw
15 Kingpin
16 Bearing, needle
17 Bearing, needle
18 Shim
19 Arm, center
20 Fitting, lubrication
21 Pin, spring
22 Fitting, lubrication
23 Shim
24 Kingpin
25 Bearing, needle

Figure 76. Steering axle with center arm, exploded view.

Section VIII. DRIVE AXLE AND DIFFERENTIAL (GROUP 11)

49. Drive Axle Assembly

a. Removal.

(1) Jack up and block truck high enough to permit removal of axle.

(2) Support axle housing assembly (1, fig. 77) to prevent falling.

(3) Remove drive wheels (TM 10-3930-222-20).

(4) Disconnect handbrake cables at handbrake lever.

(5) Remove screws and lock plate and disconnect drive shaft at differential.

(6) Disconnect hydraulic brake lines at wheel cylinders.

(7) Remove capscrews and lockwashers that secure mounting caps to frame and remove caps.

(8) Lower axle assembly from truck.

b. Disassembly.

(1) Remove axle shafts (8 and 14) from axle housing.

(2) Remove brakedrums from axle housing.

(3) Remove brakeshoe assemblies

(4) Remove brake plate assemblies from housing.

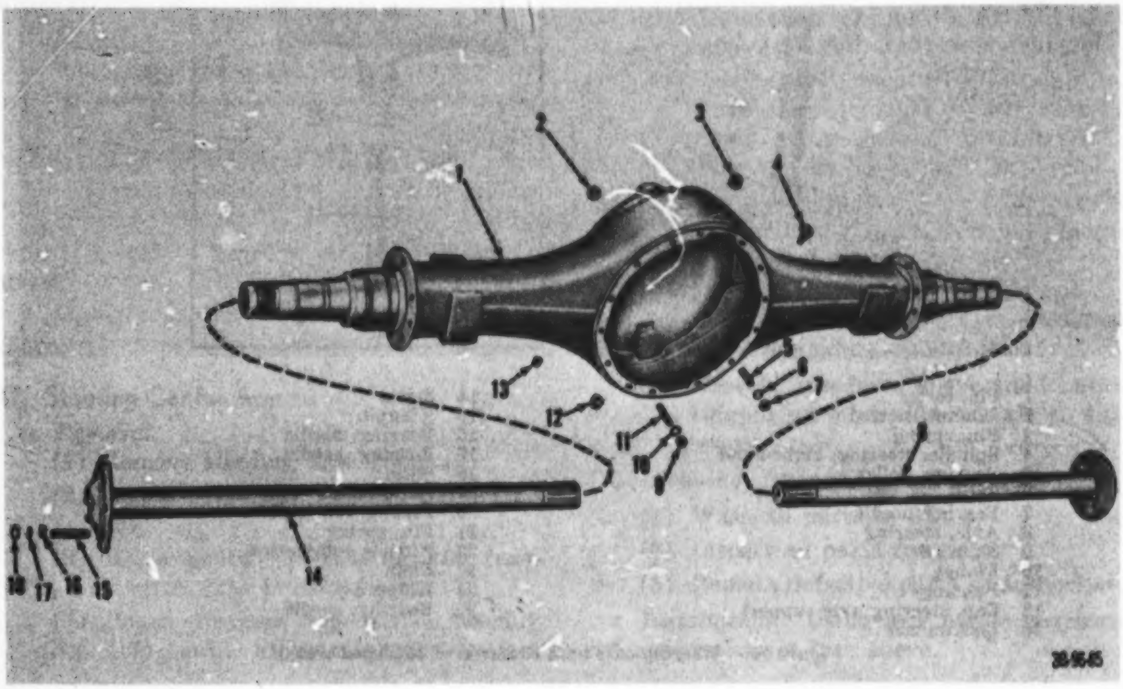
(5) Remove differential assembly from housing (par. 50*a*).

c. Inspection. Inspect axle and shafts for excessive wear, cracks, distortion, and other damages. Inspect housing for stripped threads

d. Repair. Repair housing and shafts by welding as necessary. When possible, use a tap or die and repair damaged threads.

e. Assembly. Reverse procedures in *b* above.

f. Installation. Reverse procedures in *a* above. Bleed the hydraulic brake system after connecting the hydraulic lines to the wheel cylinders.



1	Housing, drive axle	10	Washer
2	Plug	11	Stud, plain, long
3	Plug	12	Plug
4	Breather	13	Plug
5	Stud, plain, short	14	Shaft, axle
6	Washer	15	Stud
7	Nut	16	Dowel
8	Shaft, axle	17	Lockwasher
9	Nut	18	Nut, special

Figure 77. Drive axle housing and shafts, exploded view.

50. Differential and Carrier Assembly

a. Removal.

(1) Drain the differential.

(2) Remove screws and lock plate and remove drive shaft from the truck.

(3) Remove the left and right axle shafts.

(4) Remove nuts and flat washers that secure the differential assembly to the axle housing (fig. 78) and remove the differential carrier assembly from the axle housing.

b. Disassembly.

(1) Remove safety wire from capscrews (fig. 79) that secure adjusting ring lock plate (fig. 79) and remove capscrews and lock plates on both sides of differential.

(2) Mark bearing caps (fig. 79) for correct reassembly.

(3) Cut safety wires and remove capscrews and bearing caps (fig. 79) from housing.

(4) Remove adjusting nuts (fig. 79) from each side of housing.

(5) Lift out differential and gear assembly from carrier. Punch mark differential case halves for correct assembly.

(6) Cut safety wire and remove bolts (fig. 80) from differential and gear assembly and separate differential case (4, fig. 81) from ring gear (12), being careful not to drop spider (7) and side gears (6 and 10).

(7) Remove spider (7), side gears (6 and 10), and thrust washers (5 and 11) from differential case.

(8) Remove thrust washers (9) and pinion spiders (8) from spider (7).

(9) Using suitable puller, remove bearing cones (2 and 13) from differential case.

(10) If the ring gear (12) is to be replaced, remove rivets (15) by carefully center punching the rivets in the center of the head. Use a drill $\frac{1}{32}$ inch smaller than body of rivet and drill through head. Press out rivets after drilling.

(11) Refer to figure 82 and remove cotter pin, nut and washer from pinion shaft and remove yoke fitting from pinion.

(12) Remove screws that secure cover to carrier and remove cover.

(13) Remove gasket (6, fig. 83) from cover (5).

(14) Remove oil seal (7) from cover.

(15) Remove pinion and cage assembly (fig. 84) from carrier.

(16) Remove shims (12, fig. 83) from carrier (19).

(17) Remove rear pinion bearing lockring (fig. 84) and remove bearing from shaft.

(18) Press pinion (15, fig. 83) from bearing cones (8 and 14).

(19) Remove spacer (10) from pinion.

(20) Remove bearing cups (9 and 13) from cage assembly (11).

c. Cleaning and Inspection.

(1) Clean all parts with SD.

(2) Visually inspect all parts for indication of wear or stress.

(3) Inspect all bearings and cones for pitting or other damage.

(4) Inspect gears for wear, damage, or pitting.

(5) Replace parts as necessary.

d. Assembly.

(1) Press roller bearing (16, fig. 83) on pinion (15) and install lockring (17) on pinion.

(2) Press bearing cone (14) on pinion.

(3) Press bearing cup (13) into cage assembly (11).

(4) Press bearing cup (9) into cage assembly (11).

(5) Lubricate bearings and cups with GO–90 lubricating oil.

(6) Insert pinion with bearings into cage assembly (11).

(7) Position spacer (10) over pinion shaft.

(8) Press bearing cone (8) onto pinion firmly against spacer.

(9) Rotate cage several revolutions to be sure there is normal bearing contact.

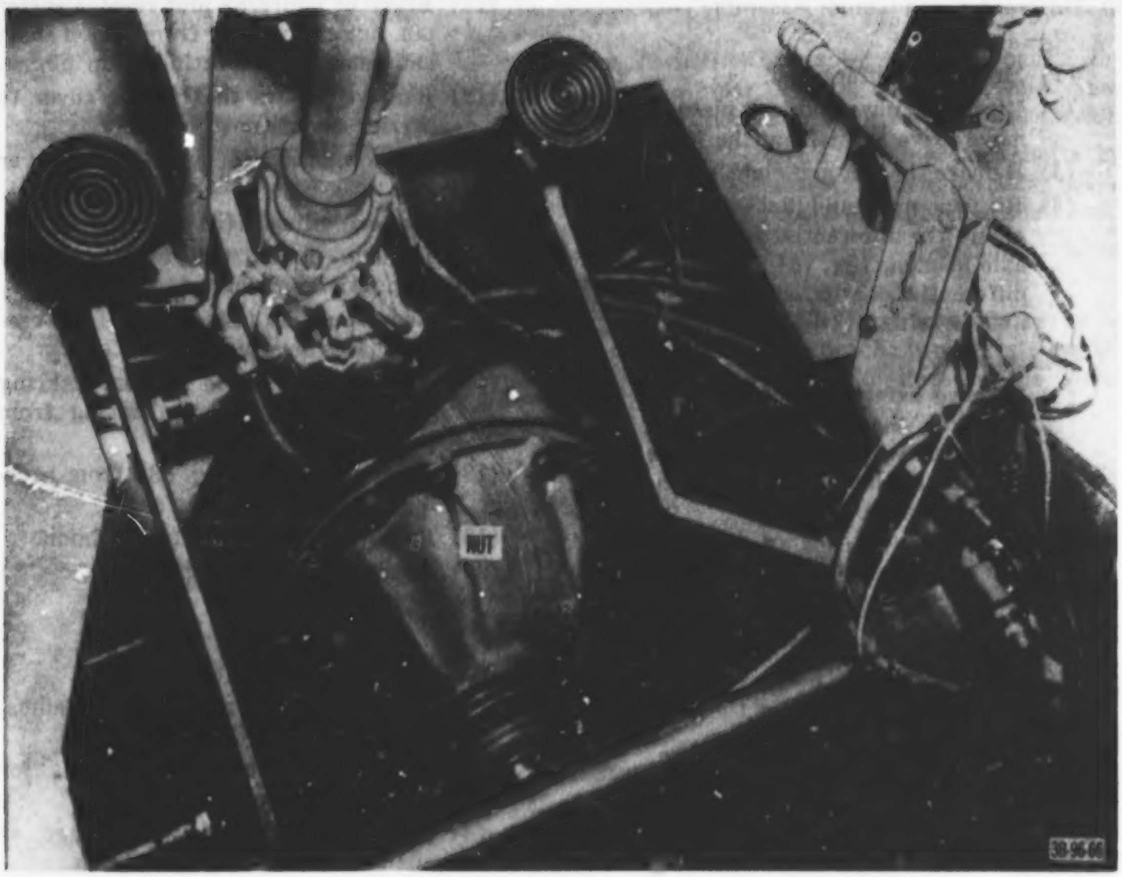


Figure 78. Drive axle and differential and carrier assembly, installed on truck.

(10) While in press under pressure, check bearing preload torque. Wrap soft wire around cage and pull on horizontal line with pound scale. If a press is not available, the pinion nut (2) may be tightened to the correct torque and preload checked.

(11) If rotating torque is not within 12 to 18 inch-pounds, use a thinner spacer to increase preload or a thicker spacer to decrease preload.

(12) Install pinion and cage assembly with shim (12) into carrier and cap assembly (19) making certain that the oil passage holes are alined.

(13) Coat outer edge of oil seal (7) with sealing compound and press seal into cover (5).

(14) Using new gasket (6), install cover and seal with gasket on carrier and cap assembly (19) with capscrews (26).

(15) Install yoke fitting (4) on pinion.

(16) Install washer (3) on pinion.

(17) Install castellated nut (2) on pinion and tighten to correct torque (700 foot-pounds) and secure with cotter pin (1).

Note. When it is necessary to replace either the pinion or ring gear, the gear set must be replaced. When a new ring gear or differential case is installed, the differential case hole must be line reamed with the gear in order to reassemble using the correct size rivets. Rivets must be upset cold. The upset head of the rivets should be one-eighth inch larger in diameter than the rivet holes.

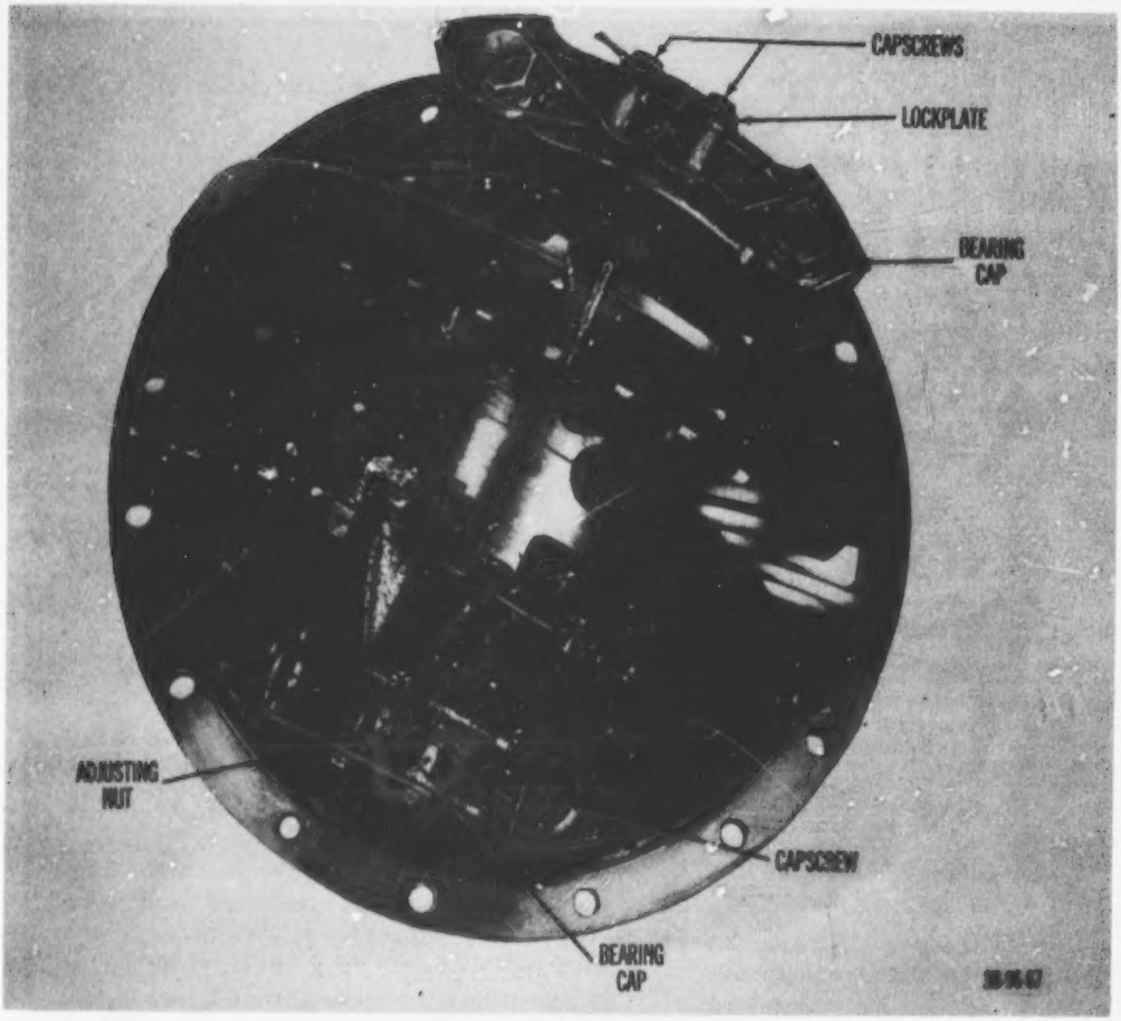


Figure 79. Differential assembly showing bearing caps.

(18) If new ring gear is to be installed, rivet ring gear (12, fig. 81) to case half, using new rivets.

(19) Lubricate differential case and all component parts with GO–90.

(20) Position thrust washer (11) and side gear (10) in ring gear (12) and case half.

(21) Place pinions (8) and thrust washers (9) on spider (7) and then place spider assembly into ring gear and case half (12).

(22) Install thrust washer (5) on side gear (6).

(23) Position side gear and washer on spider and pinion assembly.

(24) Aline punch marks and position case halves together. Secure halves with 4 bolts (3) equally spaced.

(25) Check assembly for free rotation of differential gears.

(26) Install remaining bolts (3 and 16) and torque to 96 to 106 foot-pounds.

(27) Secure bolts with safety wire (fig. 80).

(28) Press bearing cone (2, fig. 81) on case (4) and press bearing cone (13) on ring gear and case half.

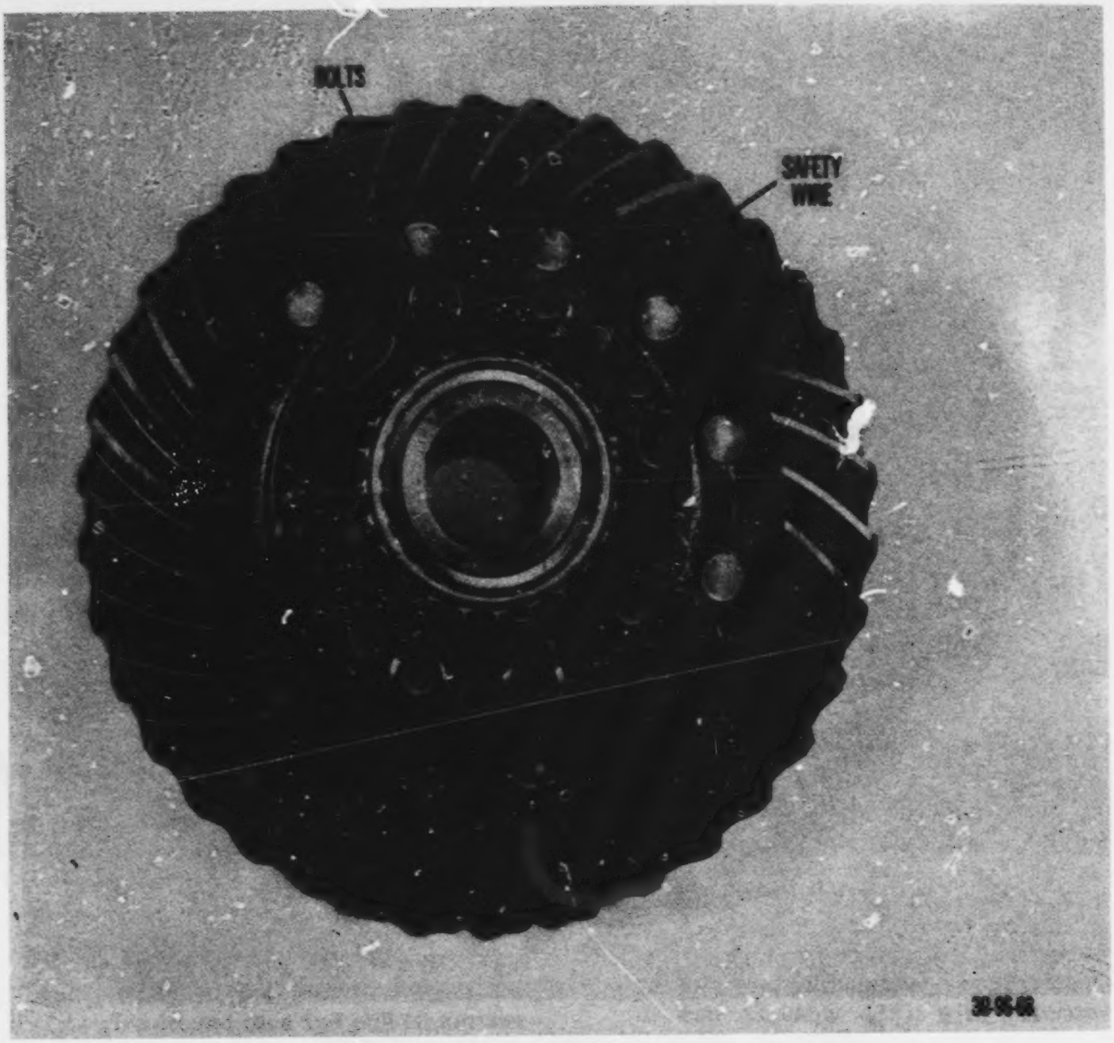


Figure 80. Differential and gear assembly.

(29) Lubricate bearing cones and bearing cups (1, and 14, fig. 81) with GO–90 and place cups over hearing cones.

(30) Position differential into carrier assembly (19, fig. 83).

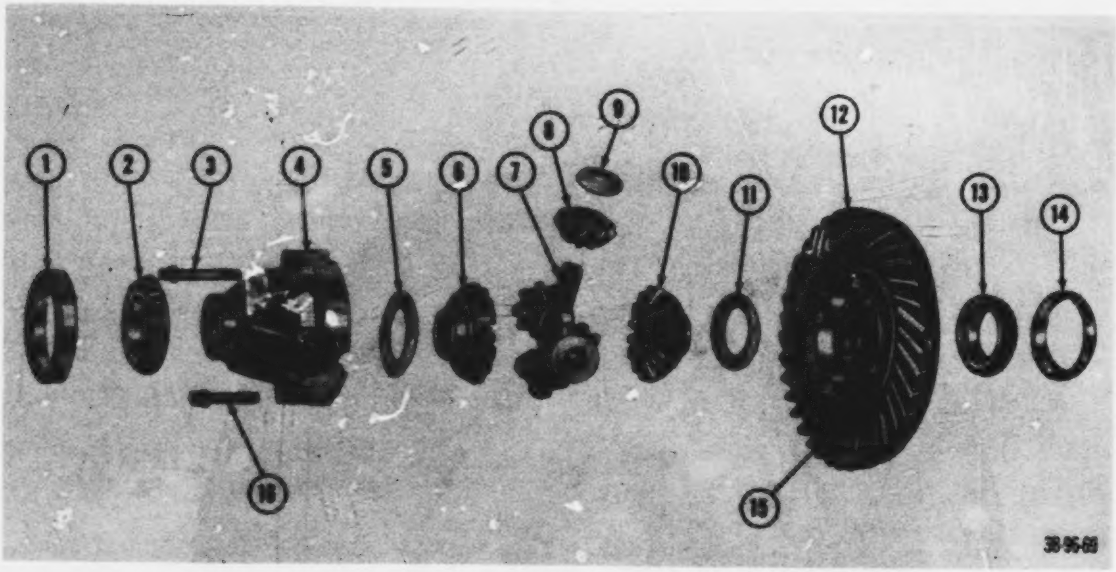
(31) Insert adjusting rings (20) and turn handtight against bearing cups (1 and 14, fig. 81).

(32) Install bearing caps (21, fig. 83) in the correct position as marked and tap lightly into position. If bearing caps do not position properly, adjusting rings may be cross threaded. Remove caps and reposition the adjusting rings. Forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

(33) Install carrier capscrews (23) and tighten snugly; then back off sufficiently to turn bearing adjusting rings.

e. Adjustment for Backlash and Tooth Contact.

(1) Screw adjusting rings into carrier and tighten down to straighten bearing caps.



1 Cup, bearing
2 Cone, bearing
3 Bolt, long
4 Case, differential
5 Washer, thrust
6 Gear, side
7 Spider
8 Pinion
9 Washer, thrust
10 Gear, side
11 Washer, thrust
12 Gear, ring
13 Cone, bearing
14 Cup, bearing
15 Rivet
16 Bolt, short

Figure 81. Drive axle differential assembly, exploded view.

Note. Turn nuts on either side alternately, so that both will be screwed into carrier assembly the same distance when tightened.

(2) Back off and adjusting ring on tooth side of ring gear and tighten opposite ring until all backlash between pinion and ring gear is removed. Back off adjusting ring on side opposite ring gear teeth approximately two notches.

(3) Tighten ring on tooth side solidly.

Note. The purpose of this is to seat the bearings. Ring must be drawn down solidly to assure proper seating.

(4) Back off this same ring free of bearing; then tighten again, however, and bring it up just enough to eliminate any play in bearings. Tighten adjusting rings one notch each from no end play to preload bearings.

(5) Mount a dial indicator with the stem perpendicular to the tooth surface at the extreme heel and measure the backlash.

Note. Correct backlash setting is between 0.006 and 0.012 inch.

(*a*) To decrease backlash, loosen adjusting ring on tooth side one notch and tighten opposite side one notch. Check backlash and repeat as necessary.

(*b*) To increase backlash, loosen, adjusting ring opposite tooth side one notch and tighten opposite ring one notch. Check backlash and repeat as necessary.

(*c*) When proper backlash has been obtained, torque differential carrier capscrews to 120 to 170 foot-pounds

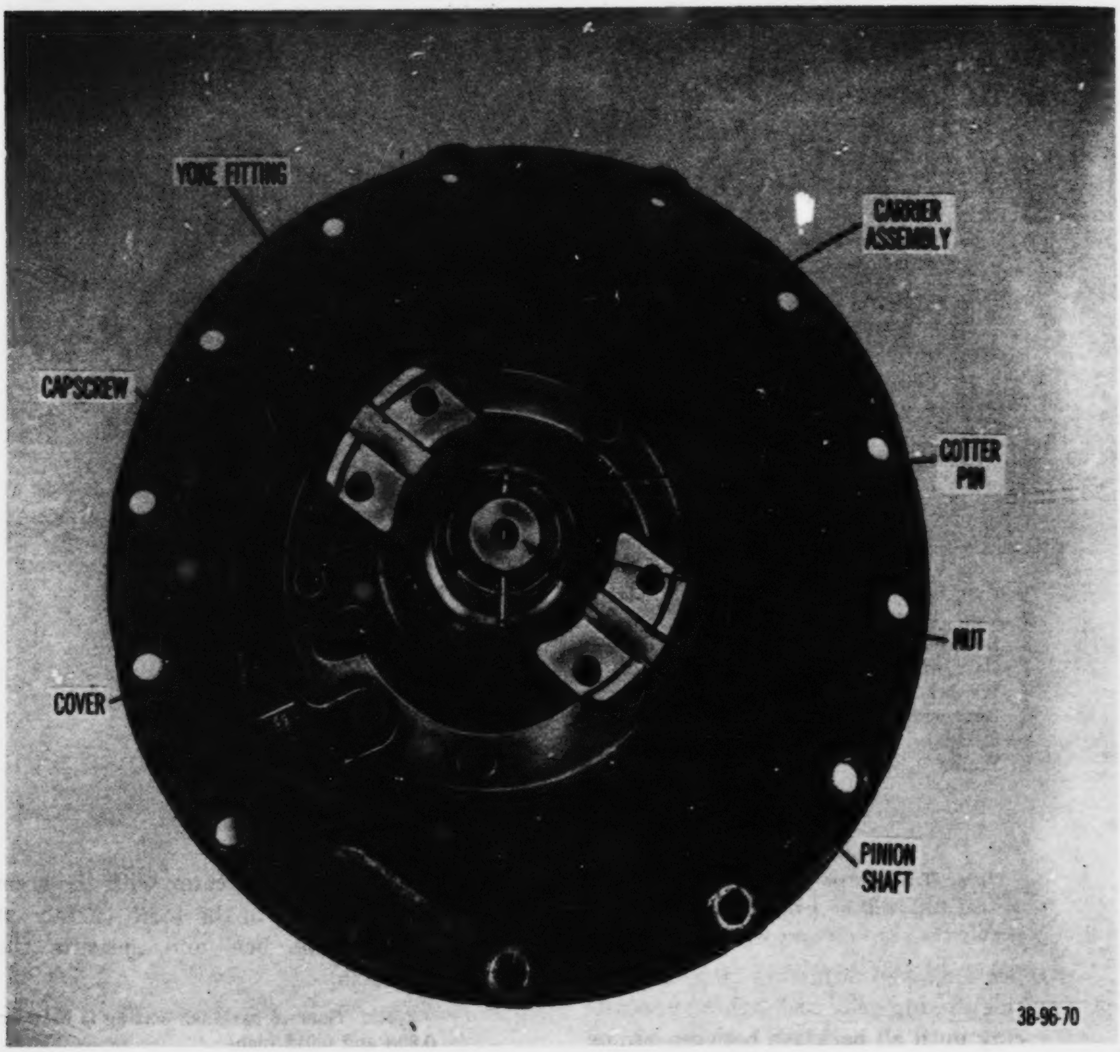


Figure 82. Carrier assembly showing yoke fitting and pinion shaft.

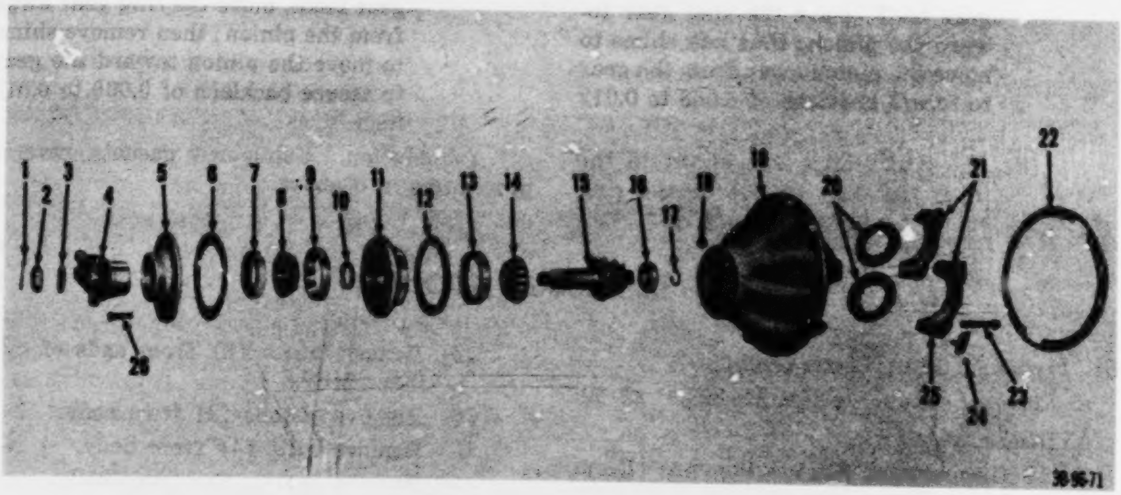
and check backlash. If setting is correct, install lock plate (25, fig. 83) and secure with capscrews. Install safety wires to secure lock plate capscrews and carrier capscrews.

(6) Check the ring gear and pinion for proper mesh by coating approximately six ring gear teeth on both sides of the high spot with red lead mixed with oil.

(7) Rotate the ring gear several times, or until clear marks of contact between ring gear and pinion are obtained.

Note. The proper mesh is indicated by a contact area covering approximately 80 percent of the tooth face, on either side, but not reaching either toe or heel, or crest or root of the tooth.

(*a*) If contact area is confined to the outer diameter or heel of the ring



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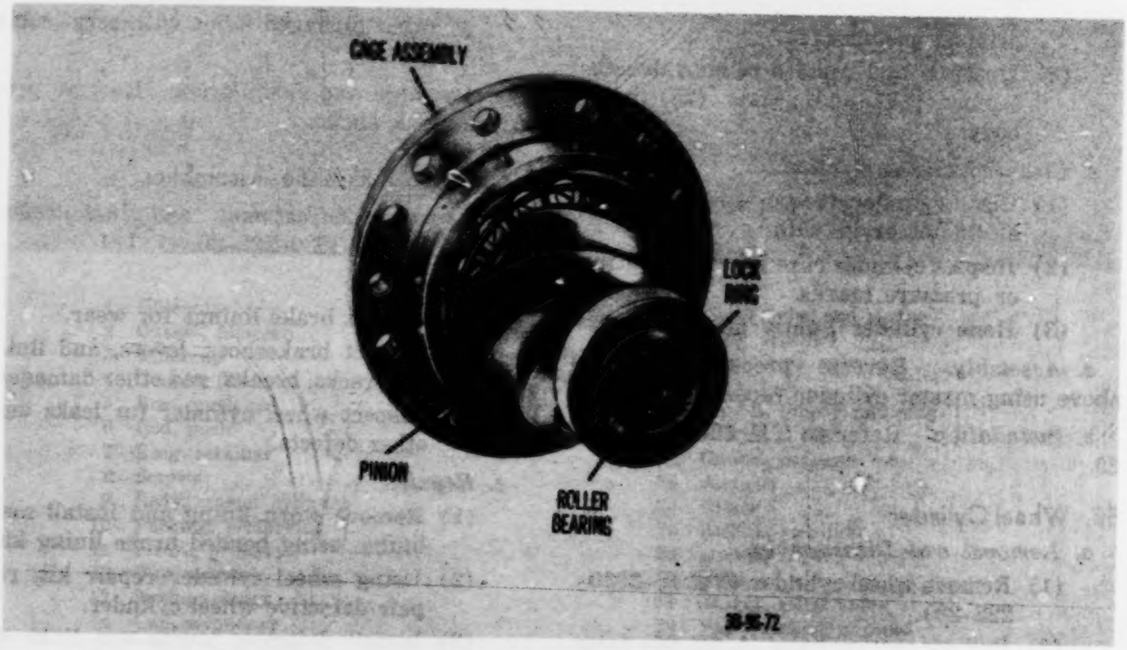
38-96-71

1 Pin, cotter
2 Nut, castellated
3 Washer
4 Fitting, yoke
5 Cover
6 Gasket, cover
7 Seal, oil
8 Cone, bearing
9 Cup, bearing
10 Spacer
11 Cage assembly
12 Shim
13 Cup, bearing
14 Cone, bearing
15 Pinion
16 Bearing, roller
17 Lockring
18 Plug
19 Carrier and cap assembly
20 Rings, adjusting
21 Caps, bearing
22 Gasket, carrier mounting
23 Capscrew, carrier
24 Capscrew
25 Lock plate
26 Capscrew

Figure 83. Differential carrier assembly, exploded view.



CAGE ASSEMBLY
LOCK RING
PINION
ROLLER BEARING
38-96-72

Figure 84. Pinion and cage assembly.

gear teeth, move the ring gear toward the pinion; then add shims to move the pinion away from the gear to secure backlash of 0.006 to 0.012 inch.

(*b*) If contact area is confined to the inner diameter or toe of the ring gear teeth, move the ring gear away from the pinion; then remove shims to move the pinion toward the gear to secure backlash of 0.006 to 0.012 inch.

f. Installation. Using new gaskets, reverse procedures in *a* above.

Section IX. BRAKES (GROUP 12)

51. Hydraulic Brake Master Cylinder

a. Removal. Refer to TM 10-3930-222-20.

b. Disassembly.

(1) Unscrew and remove fillercaps (1 and 3, fig. 85) and gaskets (2 and 4) from body (9).

(2) Remove push rod (6) and boot (5) from body.

(3) Remove end plug (19) and retaining ring (17) from body.

(4) Remove check valve seat (18), check valve and spring (16), secondary piston (15), secondary cup (14), return spring (13), primary cup (12), and primary piston (11) from body.

(5) Remove preformed packing (10) from primary piston (11).

(6) Unscrew and remove relief valve assembly (29) and gasket (28) from body.

c. Cleaning and Inspection.

(1) Clean cylinder and ports in denatured alcohol or brake fluid.

(2) Inspect cylinder bore for discoloration or pressure marks.

(3) Hone cylinder lightly as necessary.

d. Assembly. Reverse procedures in *b* above using master cylinder repair kit.

e. Installation. Refer to TM 10-3930-222-20.

52. Wheel Cylinder

a. Removal and Disassembly.

(1) Remove wheel cylinder (TM 10-3930-222-20).

(2) Pull connecting links (1, fig. 86) from wheel cylinder body (6).

(3) Remove boots (2) from ends of cylinder body.

(4) Remove pistons (3) from body.

(5) Remove cups (4) from body.

(6) Remove spring (5) from body.

b. Cleaning, Inspection, and Repair.

(1) Wash all metal parts thoroughly in denatured alcohol and dry completely with compressed air.

(2) Inspect cylinder bore and pistons for rough, scratched, or pitted surface. Hone cylinder bore as necessary. Polish pistons with crocus cloth or steel wool.

(3) Use wheel cylinder repair kit and replace parts as necessary. Replace other damaged items with serviceable ones.

c. Assembly and Installation. Reverse procedures in *a* above.

53. Service Brakeshoe Assemblies

a. Removal, Adjustment, and Installation. Refer to TM 10-3930-222-20.

b. Inspection.

(1) Inspect brake linings for wear.

(2) Inspect brakeshoes, levers, and links for cracks, breaks, and other damages.

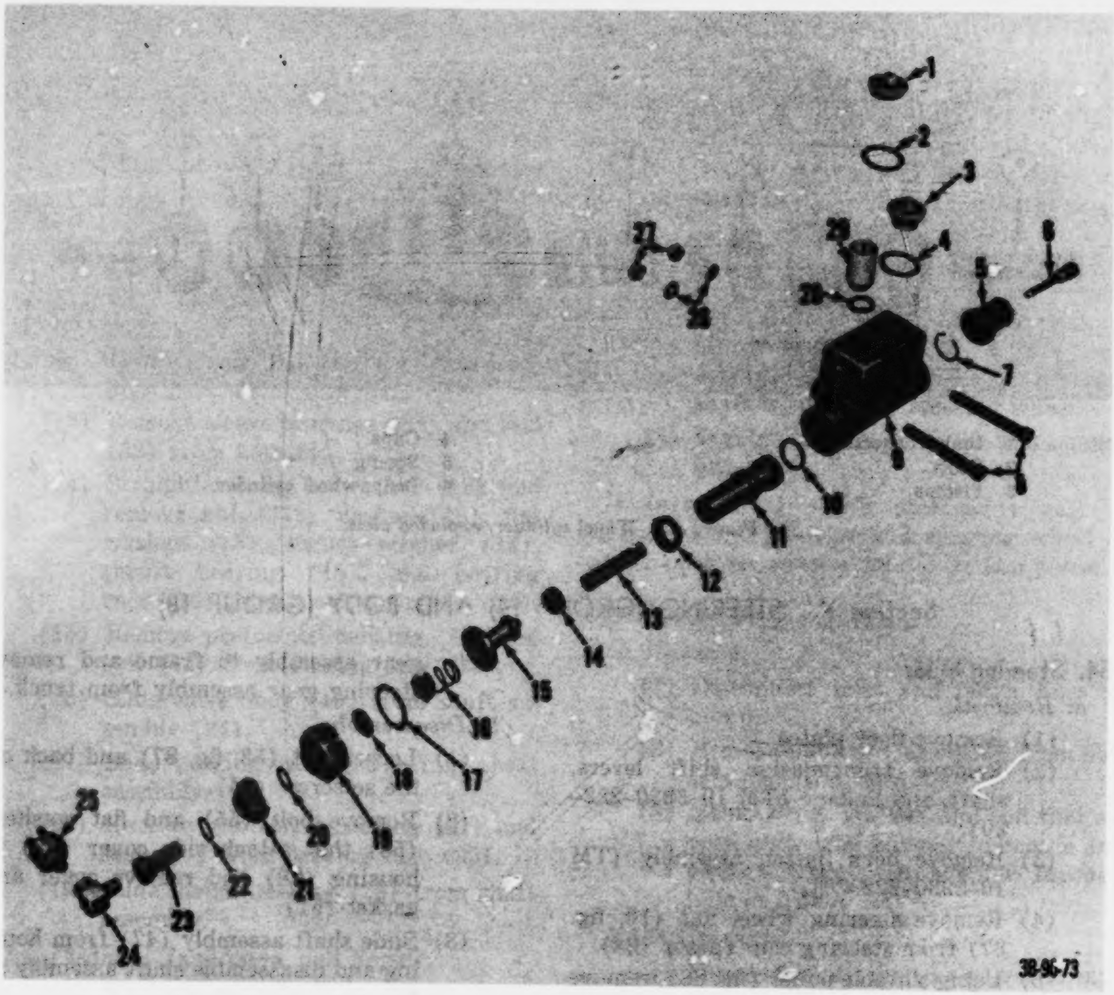
(3) Inspect wheel cylinder for leaks and other defects.

c. Repair.

(1) Remove worn lining and install new lining, using bonded brake lining kit.

(2) Using wheel cylinder repair kit, repair defective wheel cylinder.

(3) Install defective levers and links as authorized.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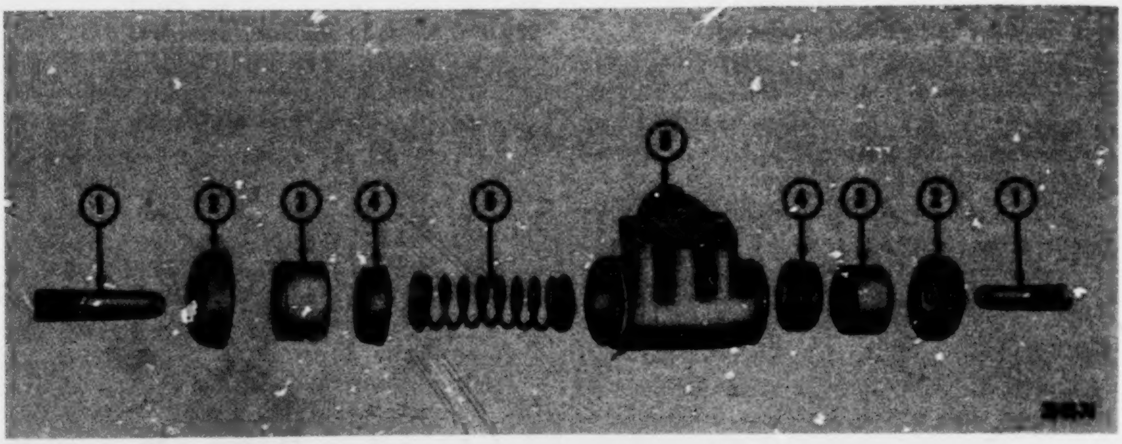
38-96-73

1	Fillercap
2	Gasket, fillercap
3	Fillercap
4	Gasket, fillercap
5	Boot, push rod
6	Rod, push
7	Ring, retainer
8	Screws
9	Body, master cylinder
10	Packing, preformed
11	Piston, primary
12	Cup, primary
13	Spring, return
14	Cup, secondary
15	Piston, secondary
16	Check valve and spring
17	Ring, retainer
18	Seat, check valve
19	Plug, end
20	Gasket, copper, end plug
21	Fitting
22	Gasket, copper
23	Adapter
24	Elbow
25	Switch, stoplight
26	Lockwashers
27	Nuts
28	Gasket, relief valve
29	Valve assembly, relief

Figure 85. Hydraulic brake master cylinder, exploded view.



1 Link, connecting
2 Boots
3 Pistons
4 Cups
5 Spring
6 Body, wheel cylinder

Figure 86. Wheel cylinder, exploded view.

Section X. STEERING (GROUP 14) AND BODY (GROUP 18)

54. Steering Gear

a. Removal.

(1) Remove floor plates.

(2) Remove transmission shift levers, shaft, and linkage (TM 10–3930–222–20).

(3) Remove horn button assembly (TM 10–3930–222–20).

(4) Remove steering wheel nut (10, fig. 87) from steering cam (post) (24).

(5) Using suitable puller (fig. 88), remove steering wheel from post.

(6) Disconnect all hydraulic lines at steering valve body (19, fig. 87).

(7) Remove nut (29) and lockwasher (30) that secure pitman arm (31) to shaft (47). Remove pitman arm.

(8) Remove steering post bracket (fig. 88) from upper cover (5, fig. 87).

(9) Remove nut and lockwasher that secure shifting shaft bracket assembly to instrument panel (fig. 88). Remove bushing if necessary.

(10) Remove nuts, lockwashers, and mounting bolts that attach steering gear assembly to frame and remove steering gear assembly from truck.

b. Disassembly.

(1) Loosen nut (53, fig. 87) and back off the setscrew (54).

(2) Remove bolt (55) and flat washers (56) that attach side cover (52) to housing (28) and remove cover and gasket (51).

(3) Slide shaft assembly (47) from housing and disassemble shaft assembly as follows:

(*a*) Slide retaining washer (43), shims (44), and thrust washer (45) from shaft.

(*b*) Straighten tang on washer (49) and remove nut (50), washer (49), and spacer (48) from bearing (46).

(*c*) Remove bearing from shaft.

(4) Remove capscrews (4) and flat washers (3) that attach upper cover assembly (5) to housing and remove cover and gasket.

(5) Mark valve body (19) and housing (28) for reassembly.

(6) Remove capscrews (4) and lockwashers (3) that attach upper cover (5) to housing and slide upper cover from steering shaft assembly (24).

(7) Remove seal (1) from upper cover assembly.

(8) Remove washer (8), roller bearing (7), and bearing sleeve (6) from cover (5).

(9) Slide steering shaft assembly (24) from housing.

(10) Remove seal (25) from top of housing.

(11) Remove bearings (26 and 38) from housing.

(12) Remove rings (27 and 39) from housing.

(13) Remove sleeve bearings (33) and seal (32) from housing.

(14) Straighten tang on washer (12) and remove nut (11), washer (12), flat washer (13), thrust washer (14), thrust bearing (15), and bearing race (16) from shaft assembly (24).

(15) Remove preformed packing (17) and seal (18) from bearing race (16).

(16) Slide valve body (19) from shaft assembly (24).

(17) Slide bearing race (22) from shaft assembly.

(18) Remove preformed packing (21) and seal (20) from bearing race (22).

(19) Slide thrust bearing (23) from shaft assembly.

c. Cleaning, Inspection, and Repair.

(1) Wash all parts in SD.

(2) Inspect all bearings for scoring or pitted conditions.

(3) Check shaft assembly (47, fig. 87) for twisted or damaged splines and wear on surfaces of sleeve bearings (33).

(4) Inspect shaft groove for chipping, scoring, and wear. Copper plating may be worn off but this in itself is not reason for replacing.

(5) Check valve body (19) for freedom of movement of plungers and springs.

(6) Replace all unserviceable parts.

d. Assembly. Using new seals and packings, reverse procedure in *b* above, making following adjustments during assembly:

(1) When installing nut (*b*(14) above), tighten against thrust bearing to 10 foot-pounds torque; then back off 10° to 20° which is approximately the width of one lug. Bend lug to secure nut.

(2) Adjust backlash between steering shaft and pitman shaft by first centering pitman shaft on steering shaft, then tighten setscrew (54, fig. 87) against steering shaft assembly (24) until shifting shaft is tight against pitman shaft. Back off setscrew until only a slight drag is felt when steering shaft is turned by steering wheel.

(3) Tighten nut (10) to 50 foot-pounds torque.

e. Installation. With steering wheels in straight ahead position and steering wheel in center position, reverse procedure in *a* above.

55. Steering Hydraulic Pump

a. Removal.

(1) Disconnect inlet and outlet lines at pump.

(2) Remove nut and lockwasher from bottom mounting stud.

(3) Remove nut, washer, and bolt that secure pump and adapter to engine and remove pump and adapter through hole in frame.

b. Disassembly.

(1) Unscrew and remove elbow and pipe (26, fig. 89) from elbow (27).

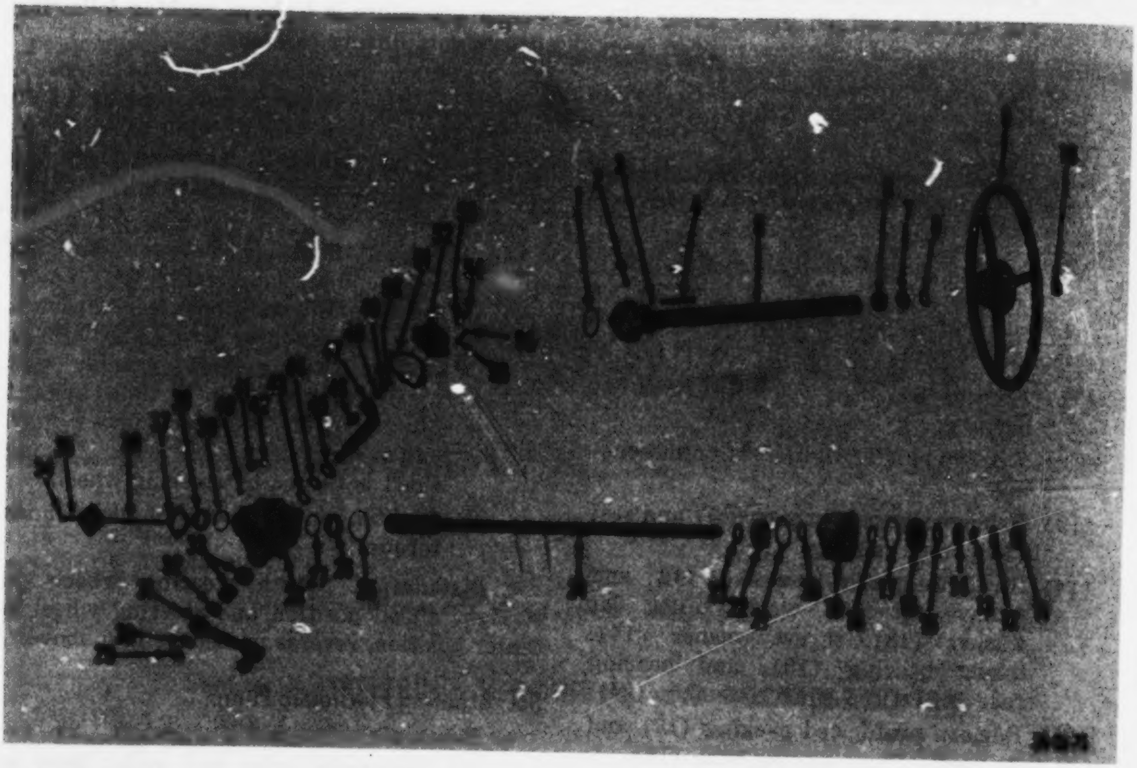
(2) Remove elbow (27) from body (19).

(3) Remove elbow fitting (17) from body (19).

(4) Press pump gear (1) from drive gear (29). Remove adapter (4), bearing (3), and ring (2).

(5) Remove key (6) from drive gear (29).

(6) Remove nuts (8), washers (9), washers (20), and screws (21) from body (19) and separate body (19) from cover (10) by gently tapping with rawhide mallet.



1	Seal
2	Plug, pipe
3	Lockwasher
4	Capscrew
5	Cover assembly, upper
6	Sleeve, bearing
7	Bearing, roller
8	Washer, bearing retaining
9	Wheel, steering
10	Nut, hexagon
11	Nut
12	Washer
13	Washer
14	Washer, thrust
15	Bearing, thrust
16	Race, bearing
17	Packing, preformed, valve, large
18	Seal, valve, small
19	Body, valve
20	Seal, valve, small
21	Packing, preformed, valve, large
22	Race, bearing
23	Bearing, thrust
24	Shaft assembly, steering
25	Seal
26	Bearing, lower tube
27	Ring, retaining, column shaft bearing
28	Housing
29	Nut
30	Washer
31	Arm, pitman
32	Seal, plain, encased
33	Bearings, sleeve, lever shaft
34	Capscrew
35	Washer
36	Cover, end
37	Gasket
38	Bearing, lower tube
39	Ring, bearing retaining, column shaft bearing
40	Plug, pipe
41	Elbow, street
42	Plug, pipe
43	Washer, retaining
44	Shim
45	Washer, thrust
46	Bearing
47	Shaft assembly, pitman
48	Spacer
49	Washer, key
50	Nut
51	Gasket
52	Cover, side
53	Nut, hexagon
54	Setscrew
55	Bolt
56	Washer

Figure 87. Steering gear, exploded view.

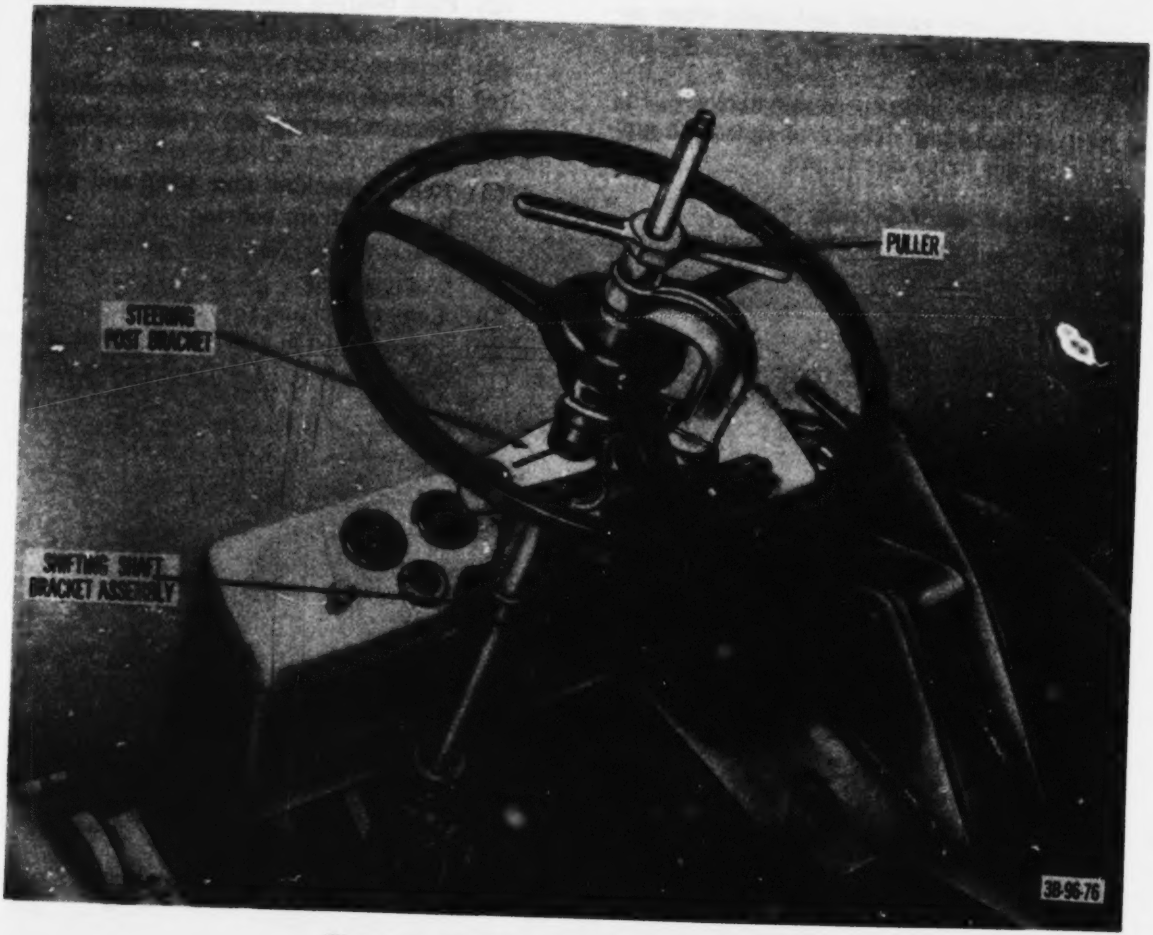


Figure 88. Steering wheel with puller attached.

(7) Remove gasket seal (18) from cover (10).

(8) Remove bearing covers (14 and 30), driven gear (15), drive gear (29), and body bearings (16 and 28) from body (19).

(9) Remove spring (13), ring seals (12), and backup washers (11) from cover (10).

(10) Remove preformed packing (5) from cover (10).

(11) Remove retaining ring (7) and shaft seal (31) from cover (10).

(12) Unscrew plugs (22 and 23). Remove spring (24) and ball (25).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in SD.

(2) Check gears for nicks, burs, cracks, or chipping.

(3) Examine gear chamber of body for evidence of gears contacting body, especially the intake cavity of the body.

(4) Inspect the body and bearings for irregularities of the bore caused by bearing attempting to turn.

(5) Examine bearings and body for signs of scratches or pitting.

(6) Replace defective parts with serviceable ones.

d. Assembly.

(1) Lubricate all parts with hydraulic fluid before assembly.

(2) Reverse procedures in *b* above.

(3) Use new gaskets and seals when assembling pump.

e. Installation.

(1) Reverse procedures in *a* above.

(2) Aline pump drive gear hole with governor drive dowell pin.

56. Steering Booster Cylinder

a. Removal. Refer to TM 10-3930-222-20.

b. Disassembly.

(1) Remove screws (26, fig. 90) and lockwashers (27) that secure end plate (28) to cylinder shell (16) and remove plate.

(2) Push bearing assembly (32) into shell until lockring (29) is exposed.

(3) Remove lockring from shell.

(4) Remove piston rod (35) from shell.

(5) Remove bearing (32) from piston rod (35).

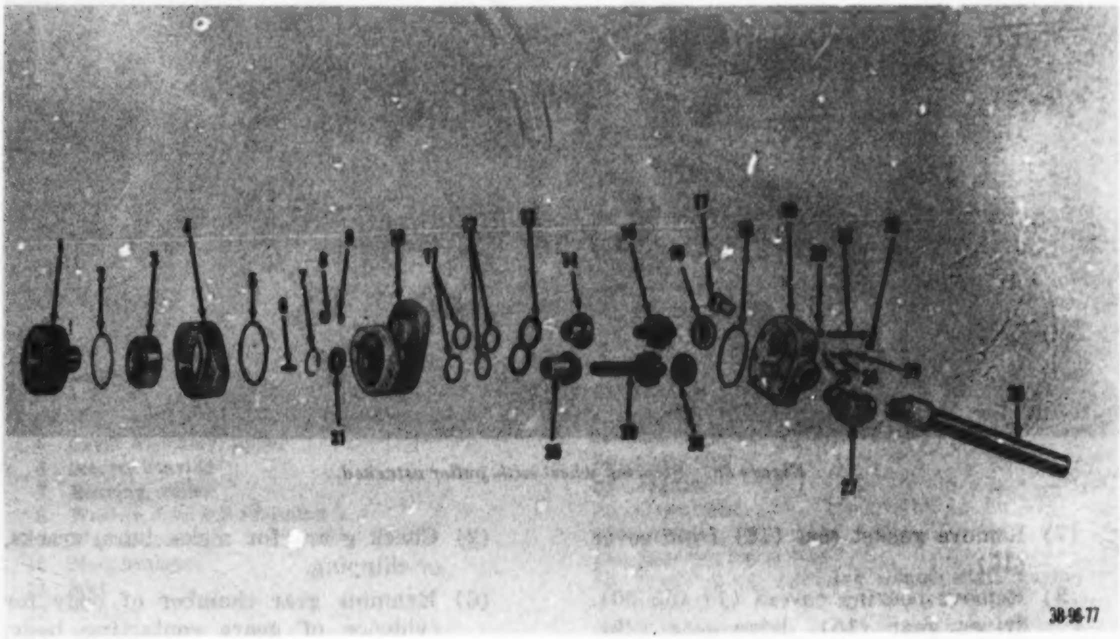
(6) Remove backup ring (34) and packing (33) from bearing.

(7) Remove seal (30) and packing (31) from bearing.

(8) Remove locknut (38) from piston rod.

(9) Remove piston (36) from piston rod.

(10) Remove rings (37) from piston (36).



1	Gear, hydraulic pump
2	Ring, retaining
3	Bearing, ball
4	Adapter, hydraulic pump
5	Packing, preformed
6	Key, woodruff
7	Ring, retaining
8	Nut
9	Washer
10	Cover
11	Washers, backup
12	Seals, ring
13	Spring
14	Cover, bearing
15	Gear, driven
16	Bearing, body
17	Elbow
18	Seal, gasket
19	Body
20	Washer
21	Screw
22	Plug, pipe
23	Plug, pipe
24	Spring
25	Ball
26	Elbow with pipe
27	Elbow
28	Bearing, body
29	Gear, drive
30	Cover, bearing
31	Seal, shaft

Figure 89. Steering hydraulic pump, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts in SD.

(2) Inspect inside of cylinder shell for burs and scratches.

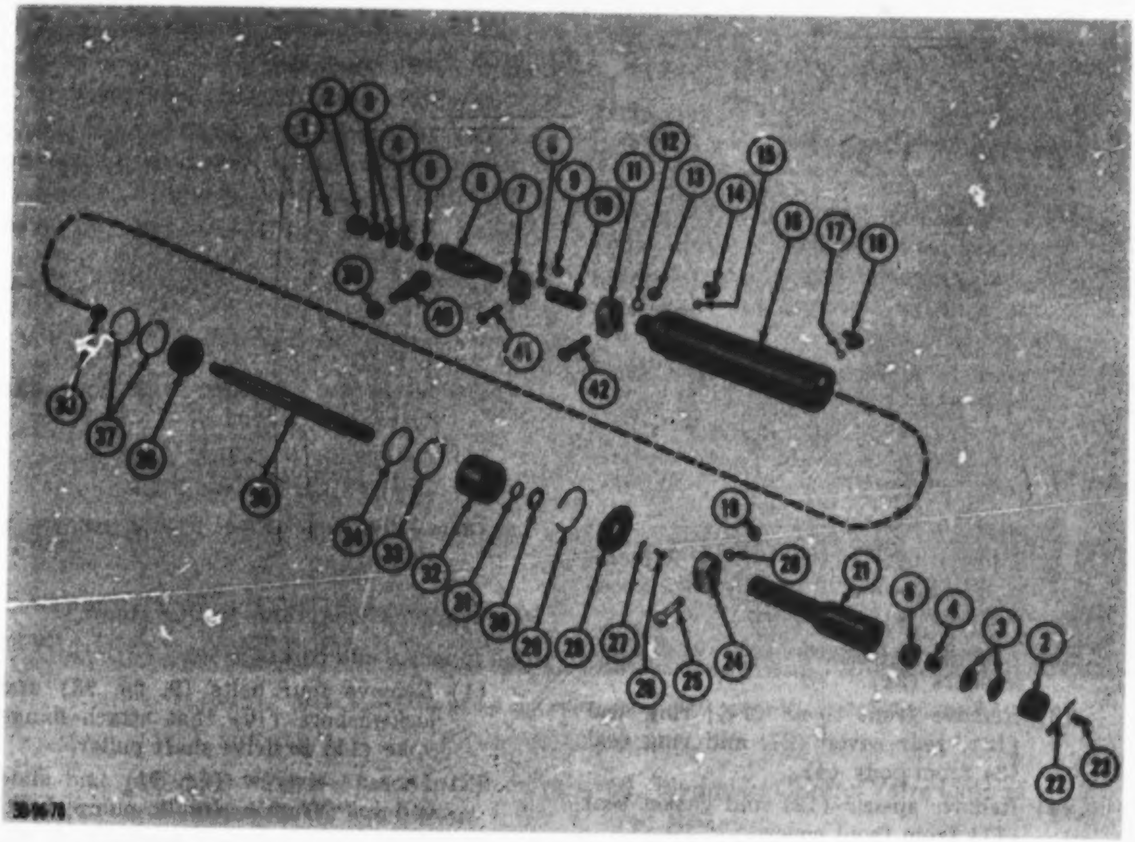
(3) Inspect piston for nicks and burs.

(4) Inspect piston rod for straightness.

(5) Inspect packing and rings for wear.

d. Assembly. Reverse procedure in *b* above using new packing, seal, and rings. Lubricate all parts with hydraulic fluid.

e. Installation. Refer to TM 10–3930–222–20.



1	Fitting, lubrication
2	Plugs, end
3	Seats, ball
4	Springs
5	Seats
6	Socket assembly, ball
7	Clamp
8	Lockwasher
9	Nut
10	Stud
11	Clamp
12	Lockwasher
13	Nut
14	Elbow, tube fitting
15	Packing, preformed
16	Shell, cylinder
17	Packing, preformed
18	Elbow, tube fitting
19	Nut
20	Lockwasher
21	Socket assembly, ball
22	Pin, cotter
23	Fitting, lubrication
24	Clamp
25	Bolt
26	Screw
27	Lockwasher
28	Plate, end
29	Lockring
30	Seal
31	Packing, preformed, inner
32	Bearing
33	Packing, preformer, outer
34	Ring, backup
35	Rod
36	Piston
37	Rings, piston
38	Locknut
39	Locknut
40	Stud, ball
41	Screw
42	Bolt

Figure 90. Steering booster cylinder, exploded view.

57. Seat Frame and Cushions

a. Removal and Installation. Refer to TM 10-3930-222-20.

b. Inspection and Repair.

(1) Inspect cushion and backrest for wear, rips, and other visible damages. If it is possible to do so, put new covers on cushions.

(2) Inspect seat frame for bends, breaks, and distortions. If it is possible to do so, straighten bends and distortions. Repair breaks by welding.

(3) Replace defective items as authorized.

Section XI. HYDRAULIC LIFT AND PUMP (GROUP 24)

58. Main Hydraulic Pump

a. Removal.

(1) Remove rear grill.

(2) Disconnect hydraulic pump drive shaft assembly (fig. 91) by removing setscrew that secures drive shaft assembly to pump.

(3) Disconnect and cap inlet and outlet hydraulic lines at pump.

(4) Remove bolts, nuts, and lockwashers that secure pump to frame and remove pump.

b. Disassembly.

(1) Remove tube elbow (20, fig. 92) and pipe-to-hose elbow (6). Remove woodruff key (9).

(2) Remove capscrews (22) and lockwashers (21).

(3) Remove front cover (14), ring seal (13), rear cover (2), and ring seal (3) from body (4).

(4) Remove spacer (12) and gasket seal (11) from front cover.

(5) Remove bearing (10) from body.

(6) Remove drive gear (8) and driven gear (18) from body.

(7) Remove bearings (7) from body.

(8) Remove shaft seal (17) from front cover (14).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in SD.

(2) Check gears for nicks, burs, cracks, or chipping.

(3) Examine gear chamber of body for evidence of gears contacting body, especially the intake cavity of the body.

(4) Inspect the body and bearings for irregularities of the bore caused by bearing attempting to turn.

(5) Examine bearings and body for signs of scratches or pitting.

(6) Replace defective parts with serviceable ones.

a. Assembly.

(1) Lubricate all parts with hydraulic fluid before assembly.

(2) Reverse procedures in *b* above.

(3) Use new baskets and seals.

e. Installation. Reverse procedures in *a* above.

59. Hydraulic Pump Drive Shaft Assembly

a. Removal and Disassembly.

(1) Remove four bolts (9, fig. 93) and lockwashers (10) that attach flange yoke (11) to drive shaft pulley.

(2) Loosen setscrew (fig. 91) and slide end yoke from hydraulic pump shaft.

(3) Straighten tangs on dust cap (6, fig. 93) and slide dust cap and gasket (7) off slip joint (8).

(4) Separate shaft (5) from slip joint.

(5) Remove dust cap and gasket from shaft.

(6) Remove retaining clips (4) from end yoke (2), shaft (5), slip joint (8), and flange yoke (11).

(7) Using brass drift, drive cross assembly through end yoke until bearing on one side protrudes far enough to be pulled out. Remove bearing. Drive cross assembly through in opposite direction until opposite bearing can be

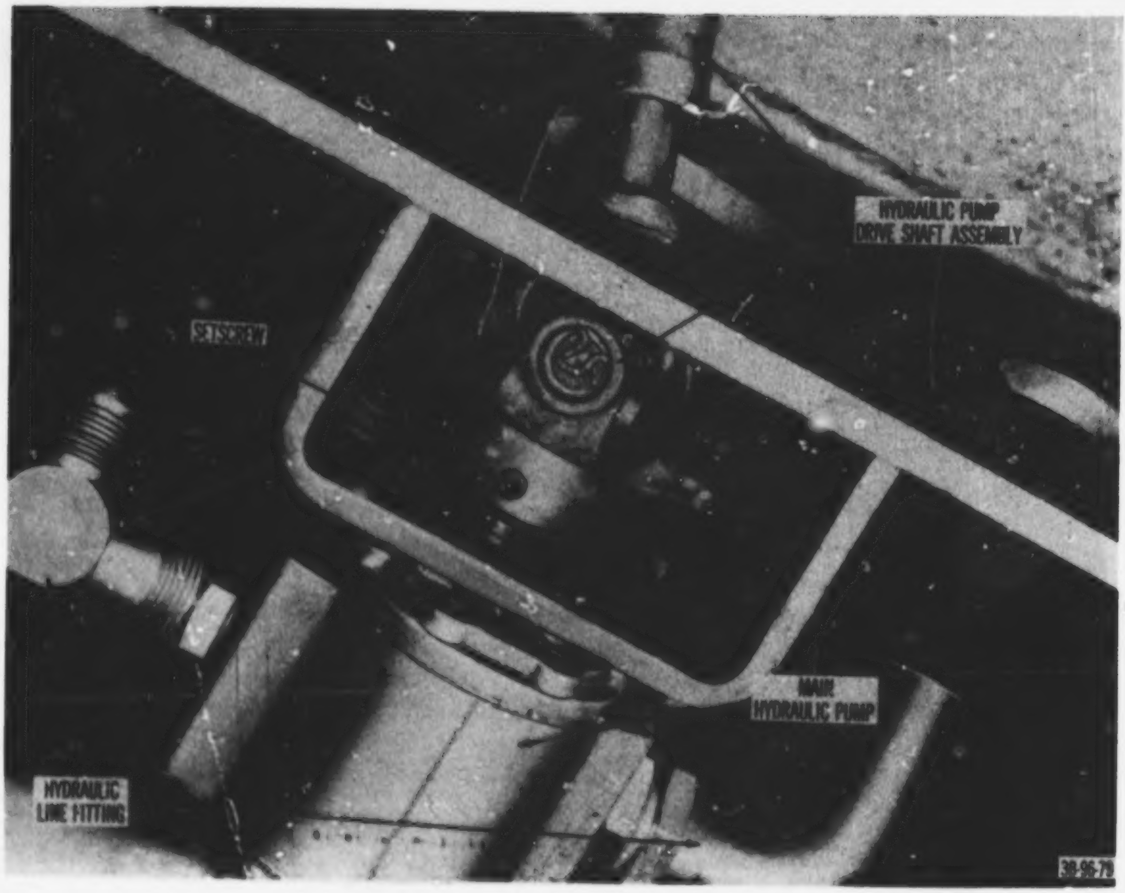


Figure 91. Main hydraulic pump and pump drive shaft assembly, installed on truck.

pulled out. Remove bearing. Remove cross assembly from end yoke.

(8) Repeat procedure in (7) above to remove two remaining bearings from cross assembly and shaft. Remove cross from shaft.

(9) Using procedures in (7) and (8) above, remove bearings from cross assembly located between slip joint and flange yoke. Remove cross assembly.

b. Cleaning, Inspection, and Repair.

(1) Clean all parts except bearings in SD.

(2) Examine all parts for good condition, and replace damaged or badly worn parts.

c. Assembly and Installation. Reverse procedures in *a* above.

60. Hydraulic Control Valve Linkage

a. Removal.

(1) Remove floor panel and seat support.

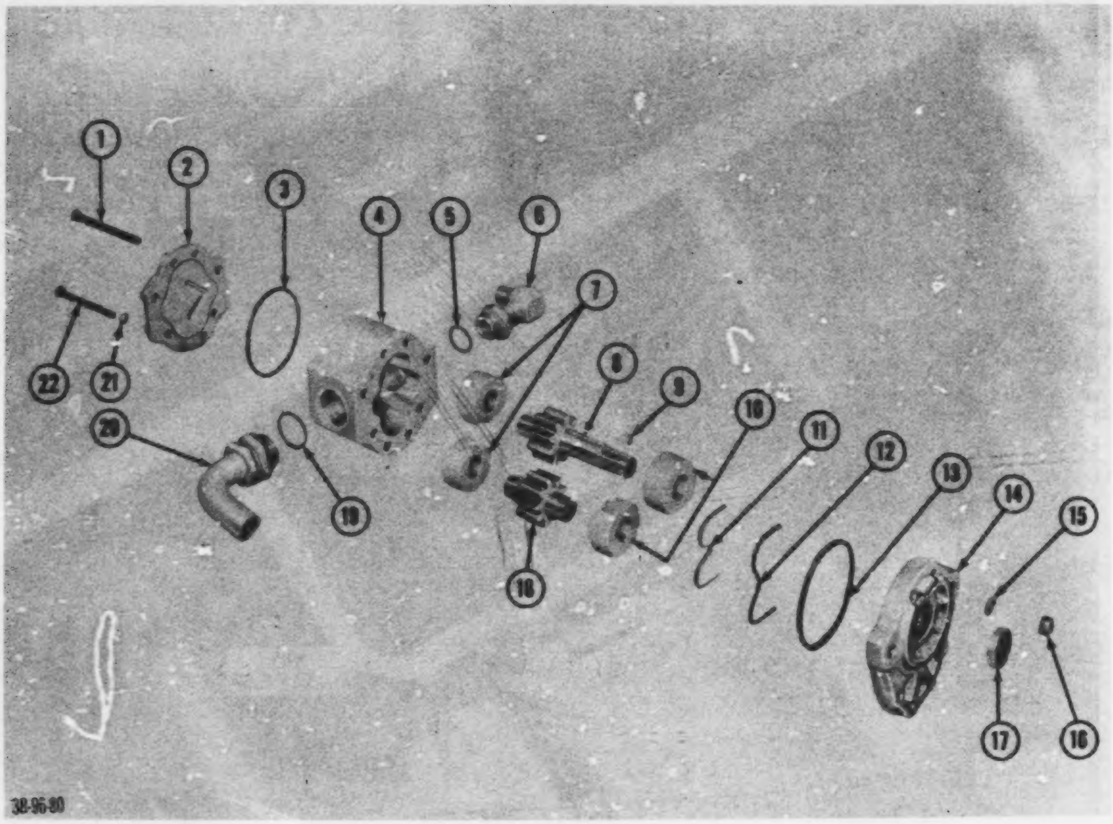
(2) Remove nut (1, fig. 93) that secures selector rod (2) to lever (3) and remove rod.

(3) Remove two cotter pins from straight, headed pins (4) and remove pins from links and valve plungers.

(4) Remove capscrews (5) and lockwashers that secure selector lever bracket (11). Remove bracket and hydraulic control valve linkage.

b. Disassembly.

(1) Remove remaining cotter pins (13 and 17, fig. 94) that connect links (12 and 18) to valve levers (8 and 22) and remove links.



1	Bolt	12	Spacer
2	Cover, rear	13	Seal, ring
3	Seal, ring	14	Cover, front
4	Body	15	Lockwasher
5	Packing, preformed	16	Nut
6	Elbow, pipe-to-hose	17	Seal, shaft
7	Bearings	18	Gear, driven
8	Gear, drive	19	Packing, preformed
9	Key, woodruft	20	Elbow, tube
10	Bearings	21	Lockwasher
11	Seal, gasket	22	Capscrew

Figure 92. Main hydraulic pump, exploded view.

(2) Remove retaining rings (10 and 21) from pin (20) and remove pin from levers (8 and 22), selector pin (7), and bracket (14).

(3) Remove levers and selector pin from bracket.

(4) Remove cotter pin (5) that secures spring (4) to selector lever pin and remove pin.

(5) Remove selector pin from lever (3).

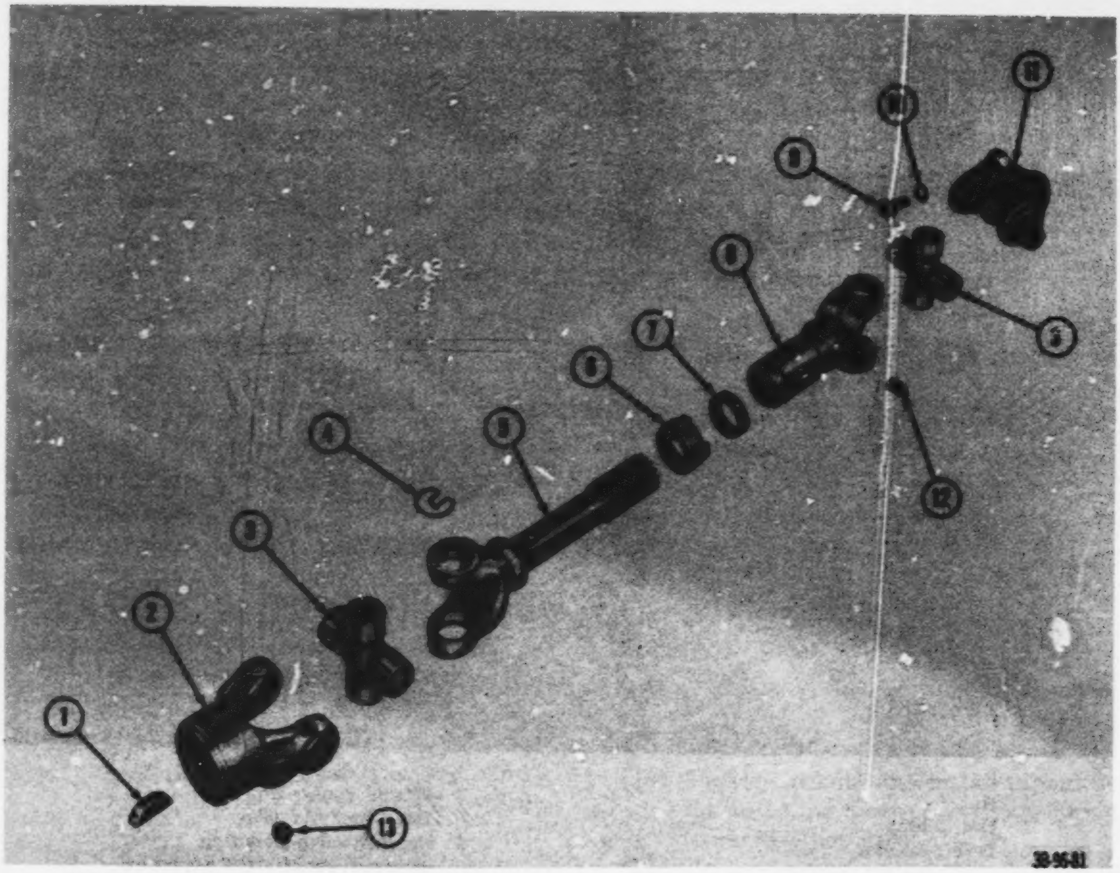
c. Inspection and Cleaning.

(1) Clean parts in SD.

(2) Inspect levers and pins for cracks and wear.

d. Assembly. Reverse procedures in *b* above.

e. Installation. Reverse procedures in *a* above.



1	Key
2	Yoke, end
3	Cross assembly with bearings
4	Clips, retaining
5	Shaft
6	Cap, dust
7	Gasket, cork
8	Joint, slip
9	Bolt, machine
10	Lockwasher
11	Yoke, flange
12	Fitting, lubrication
13	Setscrew

Figure 93. Hydraulic pump drive shaft assembly, exploded view.

61. Hydraulic Control Valve

a. Removal.

(1) Remove floor panels and seat support.

(2) Remove hydraulic control valve linkage (par. 60).

(3) Disconnect, cap, and mark all hydraulic lines that connect to the control valve.

(4) Remove bypass line fitting (7, fig. 94).

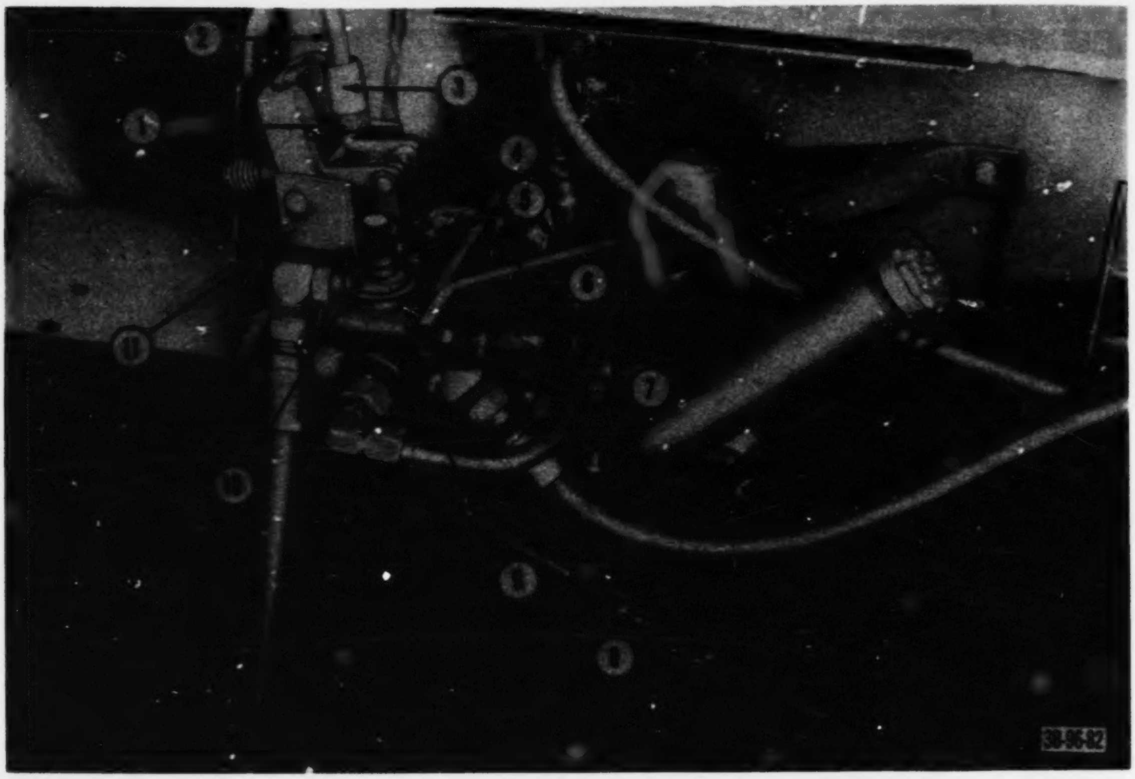
(5) Remove the nuts, lockwashers and mounting bolts (6) that secure hydraulic control valve to valve mounting bracket (9) and remove valve.

b. Disassembly.

(1) Remove all line fittings from valve.

(2) Place control valve in a vise, being careful not to damage machined surfaces.

(3) Remove relief valve capnut (1, fig. 96) from adjusting screw (5).



1	Nut
2	Rod, selector
3	Lever, selector
4	Pins, straight, headed
5	Capscrews
6	Bolts, mounting
7	Fitting bypass line
8	Hose, pump-to-valve
9	Bracket valve mounting
10	Setscrew, relief valve adjusting
11	Bracket, selector lever

Figure 94. Hydraulic control valve and linkage, installed on truck.

(4) Remove relief valve locknut (2) from adjusting screw.

(5) Unscrew adjusting screw until loose.

(6) Remove relief valve pilot plug (3) and preformed packing (4) from body (11).

(7) Slide adjusting screw (5), relief valve sleeve (8) and relief valve spring (9) from control valve body.

(8) Unscrew and remove adjusting screw (5), pilot spring (6) and relief valve poppet (7) from relief valve sleeve (8).

(9) Remove relief valve plug (13), shims, if any, and preformed packing (12) from valve body.

(10) Turn valve body, in the vise, so that plungers (14 and 23) are in a horizontal position.

(11) Make certain that there are no burs or sharp edges on the plunger eye that will scratch or groove the honed plunger bore.

(12) Mark the plungers for correct reassembly.

(13) Remove capscrews (22) that secure plunger caps (21) to valve body and remove caps.

(14) Pull plunger assemblies with wipers with rings (15) and seal plates (16) from valve body.

(15) Place plungers in brass-jawed vise and unscrew special screws (20) from plungers. Remove spring seats (19), plunger springs (18), spring seats (17), seal plates (16), and wipers with backup rings (15) from plungers.

(16) Remove packing rings (10) from valve body.

(17) Carefully unscrew check valve plugs (24 and 28) from valve body because spring and check valve in body is under tension.

(18) Remove check valve springs (26 and 30) and check valve poppets (27 and 31). Mark poppets for reassembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with SD.

(2) Inspect plunger bores in valve body for nicks and scratches.

(3) Inspect plungers for nicks and burs.

(4) Replace any defective or damaged part.

d. Assembly.

(1) Lubricate all parts before assembly with hydraulic fluid.

(2) Make sure plungers are placed in their respective bores and the same amount of shims are in the relief valve plugs.

(3) Using fine lapping compound, lapp the check valve poppets (27 and 31) and seats. Be sure to remove all traces of compound from poppets and seats.

(4) Be sure each poppet is assembled on its respective seat.

(5) Using new preformed packing, assemble valve by reversing procedures in *b* above.

e. Installation. Reverse procedures in *a* above.

f. Adjustment.

(1) Install tee fitting between outlet hose of the pump (8, fig. 94) and the control valve and install hydraulic pressure gage in the tee fitting.

(2) Remove capnut and loosen locknut on the adjusting screw.

(3) Use a screwdriver and tighten adjusting screw until it can no longer be turned.

(4) Operate engine at 600 rpm.

(5) Tilt mast back against stop.

(6) The pressure gage should read 100 to 150 psi above the required setting of 1,800 psi.

(7) If pressure is too high, remove shims from relief valve spring plug (13, fig. 96).

(8) If pressure is too low, add shims to relief valve plug.

(9) After removing or adding shims as needed, loosen valve adjusting screw a few turns to obtain 1,800 psi setting on gage.

Caution: **Do not hold control valve in tilt position longer than necessary to obtain pressure reading.**

(10) Tighten locknut and install capnut on the adjusting screw, being careful not to change the adjustment.

(11) Recheck pressure and remove gage.

g. Tests.

(1) *Plunger operation.* Move control lever to operate each plunger to its power position. Lever and plunger should return, unassisted, to its neutral position.

(2) *External leakage.* Move control lever through all positions; then check valve ports, fittings, and plungers for any evidence of leaks.

1	Knob, lever rod	12	Links, connecting, valve levers-to-valve
2	Rod, selector	13	Pins, cotter
3	Lever, selector	14	Bracket, selector lever
4	Spring, selector lever	15	Lockwashers
5	Pin, cotter	16	Capscrew
6	Nut	17	Pins, cotter
7	Pin, selector lever	18	Links, connecting, valve levers-to-valve
8	Lever, lift	19	Pins, straight, headed
9	Spacer, lift	20	Pin, selector-to-levers
10	Ring, retaining	21	Ring, retaining
11	Pins, straight, headed	22	Lever, tilt

Figure 95. Hydraulic control valve linkage, exploded view.

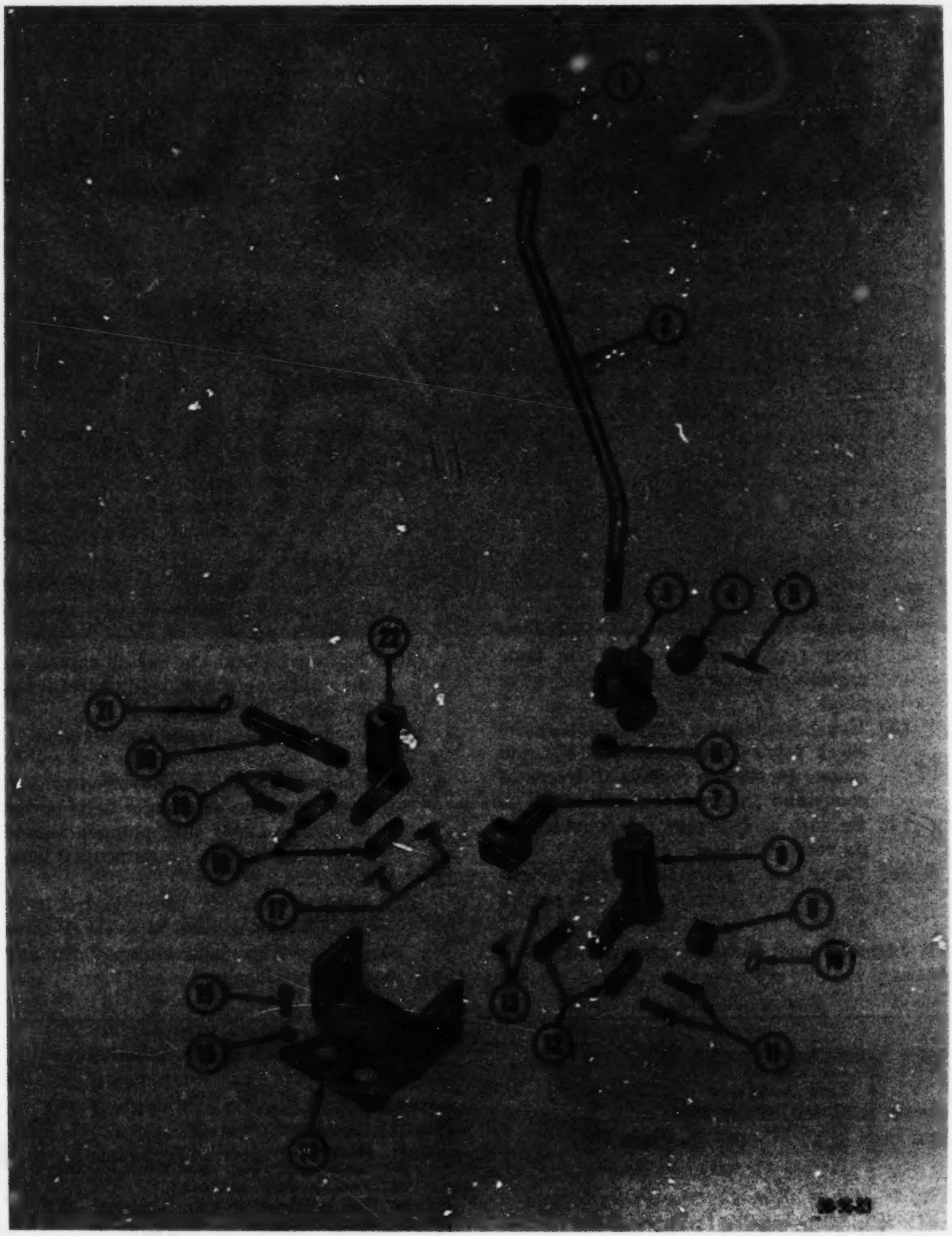

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Figure 95—Continued.

(3) *Check valve poppets.* Operate control lever to raise load to half of lift height; then move lift control to neutral. After a slight pause move lever to lift position. The lift should neither hesitate nor drop slightly but raise smoothly. Should either hesitation or drop occur, the valve poppet must be repaired. Repeat above procedure, operating tilt cylinder, to test second valve poppet.

62. Flow Divider

a. Removal.

(1) Disconnect and cap hydraulic lines at flow divider.

(2) Disconnect vent line at flow divider.

(3) Remove capscrews and lockwashers that secure divider (4, fig. 97) to bracket and remove divider.

(4) If necessary, unscrew and remove the eblows (8, 9, 12, and 13) and fitting (2) from body.

b. Installation. Reverse procedures in *a* above.

63. Flow Divider Bracket

a. Removal.

(1) Remove control valve (par. 61).

(2) Remove flow divider (par. 62).

(3) Remove nuts, lockwashers, and screws that secure bracket to hydraulic tank and remove bracket.

b. Installation. Reverse procedures in *a* above.

64. Tilt Control Valve

a. Removal.

(1) Remove floor panels.

(2) Disconnect, cap, and mark all hydraulice lines at the valve.

(3) Remove bolts and lockwashers that secure valve to truck and remove valve.

b. Disassembly.

(1) Remove elbows (13 and 14, fig. 98) from valve body (15).

(2) Remove preformed packing (6) from elbows.

(3) Remove adapters (5) from body.

(4) Remove packing (6) from adapters.

(5) Remove plugs (1), springs (3), and check balls (4) from body.

(6) Remove packing (2) from plugs (1).

(7) Remove adapter (12), spacer (10), spool (8) and spring (7) from body.

(8) Remove preformed packing (9) from spool (8).

(9) Remove packing (11) from adapter (12).

c. Inspection, Cleaning, and Repair.

(1) Clean all parts with SD and dry with compressed air to clean out foreign matter.

(2) Check for weak springs and sticking spool.

(3) Replace defective parts with serviceable ones.

d. Assembly. Reverse procedures in *b* above using new packing.

1	Capnut, adjusting screw
2	Locknut, adjusting screw
3	Plug, relief valve pilot
4	Packing, preformed
5	Screw, adjusting
6	Spring, relief valve pilot
7	Poppet, relief valve
8	Sleeve, relief valve
9	Spring, relief valve
10	Rings, packing, valve plunger
11	Body, valve
12	Packing, preformed
13	Plug, relief valve spring
14	Plunger, single action
15	Wiper with backup ring, plunger
16	Plate, seal
17	Seat, spring
18	Spring, plunger
19	Seat, spring
20	Screw, special
21	Cap, plunger
22	Capscrews, cap-mounting
23	Plunger, double action
24	Plug, check valve
25	Packing, preformed
26	Spring, check valve
27	Poppet, check valve
28	Plug, check valve
29	Packing, preformed
30	Spring, check valve
31	Poppet, check valve

Figure 96. Hydraulic control valve, exploded view.

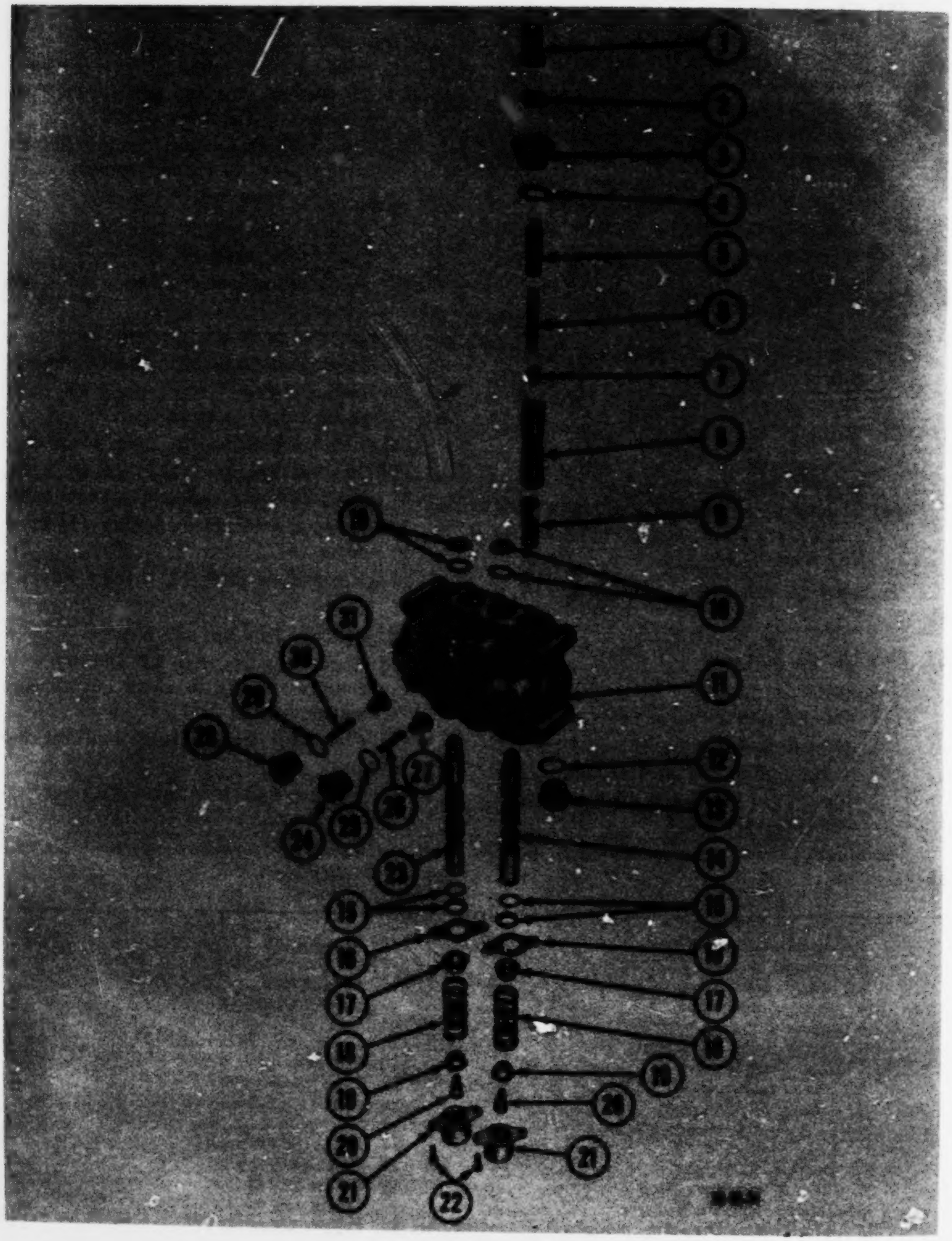
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Figure 96—Continued.

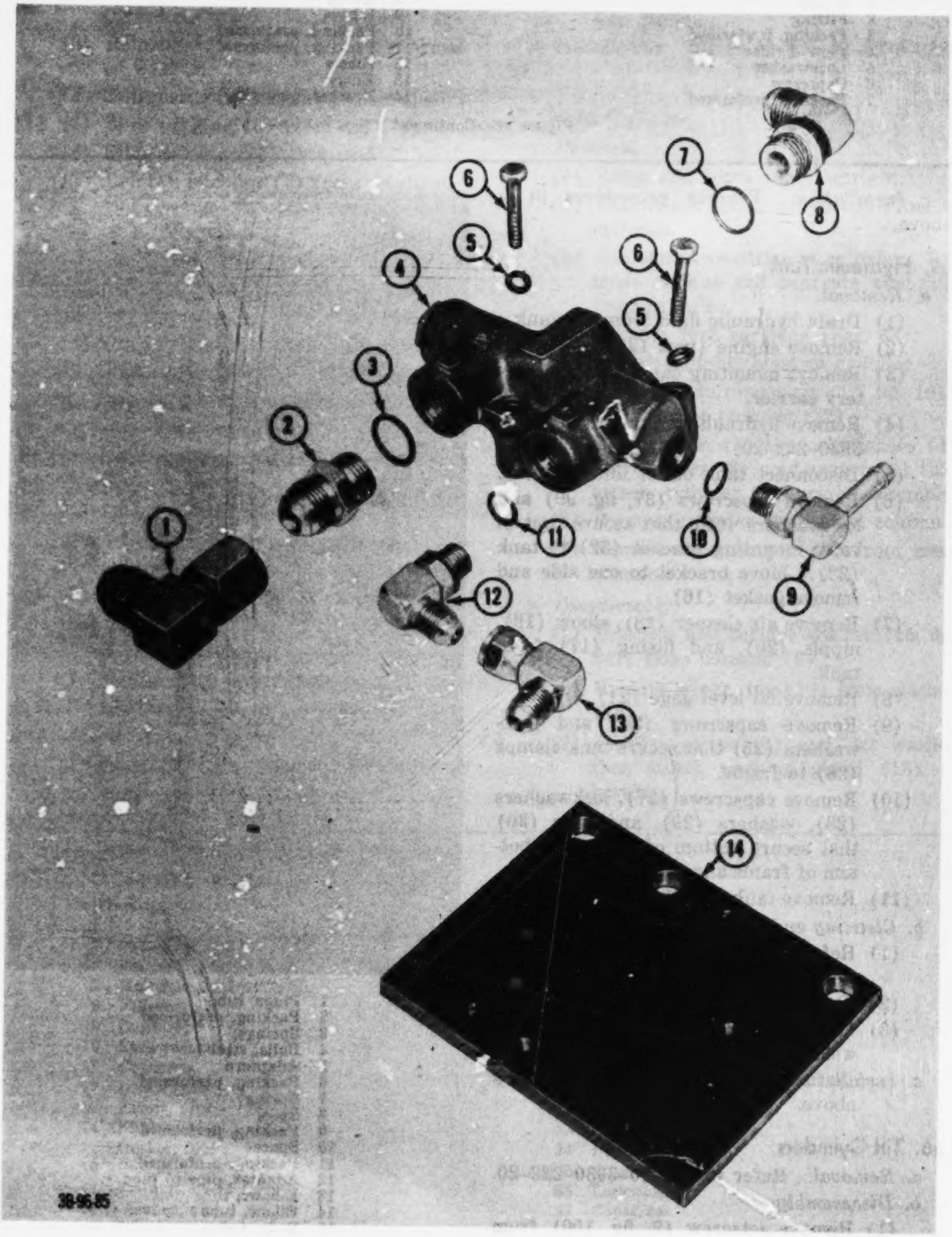
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Figure 97. Flow divider, showing attaching parts.

1	Elbow
2	Fitting
3	Packing, preformed
4	Flow divider
5	Lockwasher
6	Capscrew
7	Packing, preformed
8	Elbow
9	Elbow
10	Packing, preformed
11	Packing, preformed
12	Elbow
13	Elbow
14	Bracket, mounting

Figure 97—Continued.

e. Installation. Reverse procedures in *a* above.

65. Hydraulic Tank

a. Removal.

(1) Drain hydraulic fluid from the tank.

(2) Remove engine (par. 12).

(3) Remove mounting capscrews and battery carrier.

(4) Remove hydraulic tank filter (TM 10–3930–222–20).

(5) Disconnect tank outlet lines at tank.

(6) Remove capscrews (37, fig. 99) and lockwashers (36) that secure control valve mounting bracket (32) to tank (22). Move bracket to one side and remove gasket (16).

(7) Remove air cleaner (18), elbow (19), nipple (20), and fitting (17) from tank.

(8) Remove oil level gage (21).

(9) Remove capscrews (24) and lockwashers (25) that secure tank clamps (26) to frame.

(10) Remove capscrews (27), lockwashers (28), washers (29), and nuts (30) that secure bottom of clamps to bottom of frame and remove clamps.

(11) Remove tank from truck.

b. Cleaning and Repair.

(1) Refer to TM 10–3930–222–20 for cleaning procedures.

(2) Straighten tank as necessary.

(3) Using necessary safety precautions, weld cracks, leaks, or other ruptures.

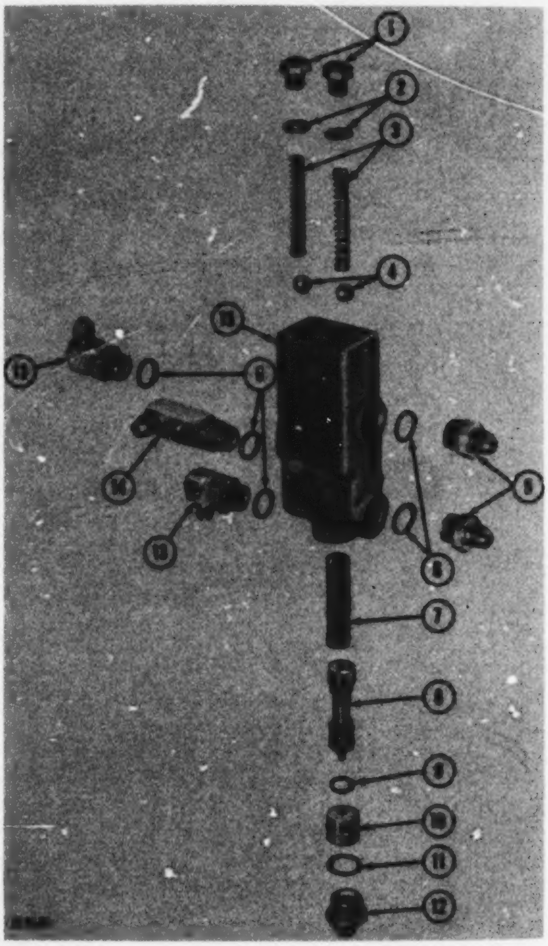
c. Installation. Reverse procedures in *a* above.

66. Tilt Cylinders

a. Removal. Refer to TM 10–3930–222–20.

b. Disassembly.

(1) Remove setscrew (2, fig. 100) from threaded washer (3).



1	Plugs, tube
2	Packing, preformed
3	Springs
4	Balls, steel
5	Adapters
6	Packing, preformed
7	Spring
8	Spool
9	Packing, preformed
10	Spacer
11	Packing, preformed
12	Adapter, pipe to tube
13	Elbows, tube
14	Elbow, tube
15	Body, valve

Figure 98. Tilt control valve, exploded view.

(2) Using suitable wrench, unscrew threaded washer (3) from shell (22).

(3) Remove wiper ring (4) from threaded washer.

(4) Pull piston rod assembly from shell.

(5) Slide packing (5) from rod (11).

(6) Slide retainer (6) from rod.

(7) Remove packing (7) from retainer.

(8) Remove bushing (8) from rod.

(9) Remove backup ring (9) and packing (10) from bushing (8).

(10) Remove nut (16) from piston rod (11).

(11) Remove piston half (15) from rod.

(12) Remove packing (14) from rod.

(13) Remove packing assembly (13) from piston half (15).

(14) Remove piston half (12) from rod.

c. *Cleaning, Inspection, and Repair.*

(1) Clean all parts in SD.

(2) Inspect inside of cylinder shell for burs and scratches.

(3) Inspect piston for nicks and burs.

(4) Inspect piston rod for straightness.

(5) Inspect packing and rings for wear.

(6) Replace defective parts with serviceable ones.

d. *Assembly.*

(1) Lubricate all parts with hydraulic fluid.

(2) Reverse procedures in *b* above using new packing.

e. *Installation.* Refer to TM 10-3930-222-20.

67. Hoist Cylinder

a. *Removal.*

(1) Raise and block inner upright.

(2) Disconnect and cap hydraulic line at cylinder.

(3) Disconnect vent line at cylinder. Remove clamps and separate vent line from cylinder.

(4) Remove fork carriage (par. 68).

(5) Attach suitable hoist to cylinder.

(6) Remove retaining ring (13, fig. 101) from top of plunger (12).

(7) Remove screws (5), lockwashers (4) flat washers (3), and spacer (2) that attach cylinder to upright assembly.

(8) Remove cylinder from mast column.

(9) Remove fulcrum pin (1) from mast column.

b. *Disassembly.*

(1) Unscrew and remove washer (15, fig. 101) from housing (6).

(2) Remove wiper ring (14) from washer (15).

(3) Remove screw (7) and flat washer that attach packing gland (18) to housing.

1	Filter assembly	20	Nipple, pipe
2	Washer	21	Gage, oil level
3	Bolt, machine	22	Tank, hydraulic
4	Gasket	23	Pad, felt
5	Fitting, elbow	24	Capscrew
6	Fitting, elbow	25	Lockwasher
7	Manifold, hydraulic fill	26	Clamp
8	Fillercap	27	Capscrew
9	Capscrew	28	Lockwasher
10	Lockwasher	29	Washer
11	Capscrew	30	Nut
12	Lockwasher	31	Plugs, pipe
13	Elbow, pipe	32	Bracket, mounting
14	Fitting, pipe	33	Screw
15	Gasket, filter	34	Fitting, pipe
16	Gasket	35	Plug
17	Fitting, pipe	36	Lockwasher
18	Cleaner, air	37	Capscrew
19	Elbow, pipe		

Figure 99. Hydraulic tank, exploded view.

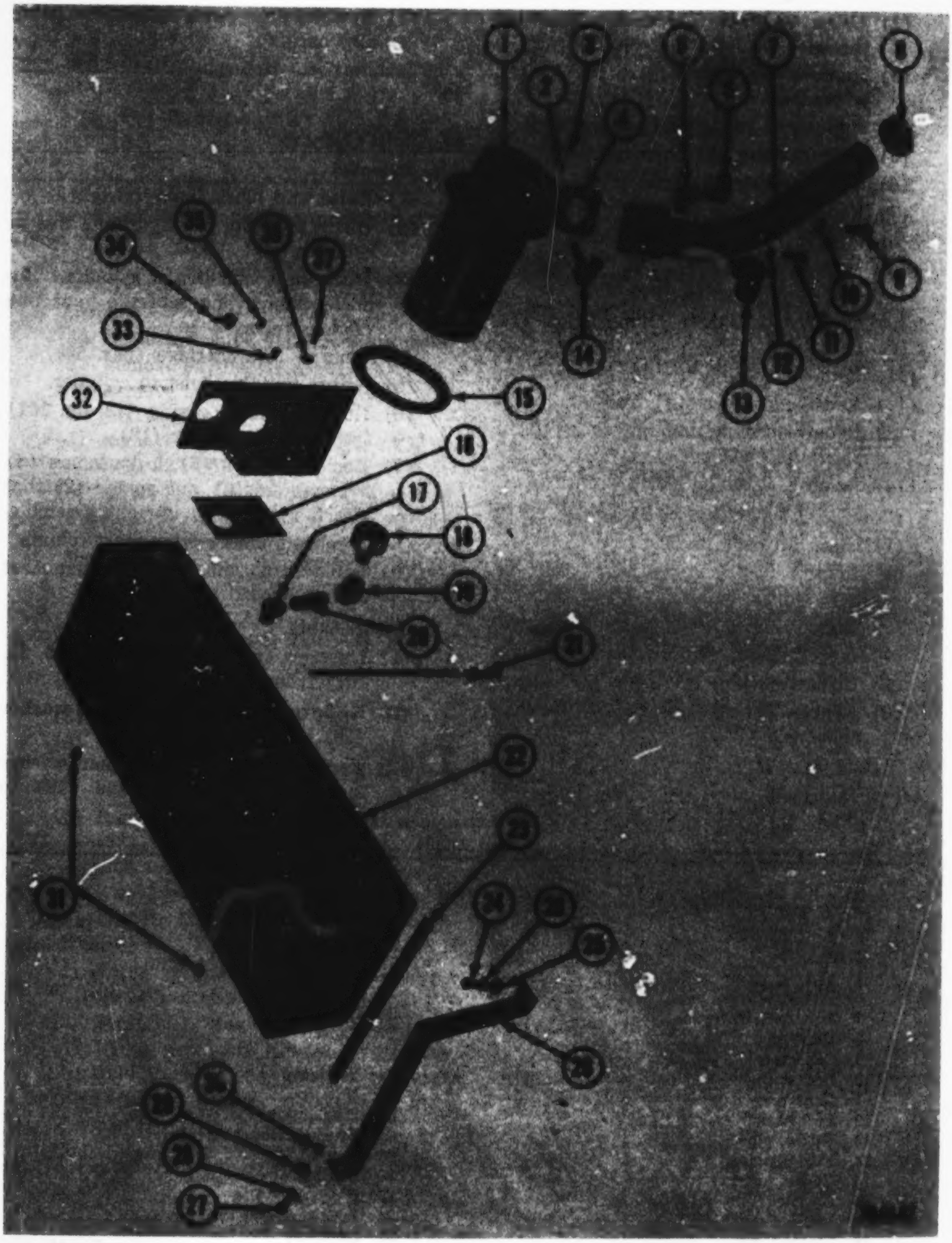

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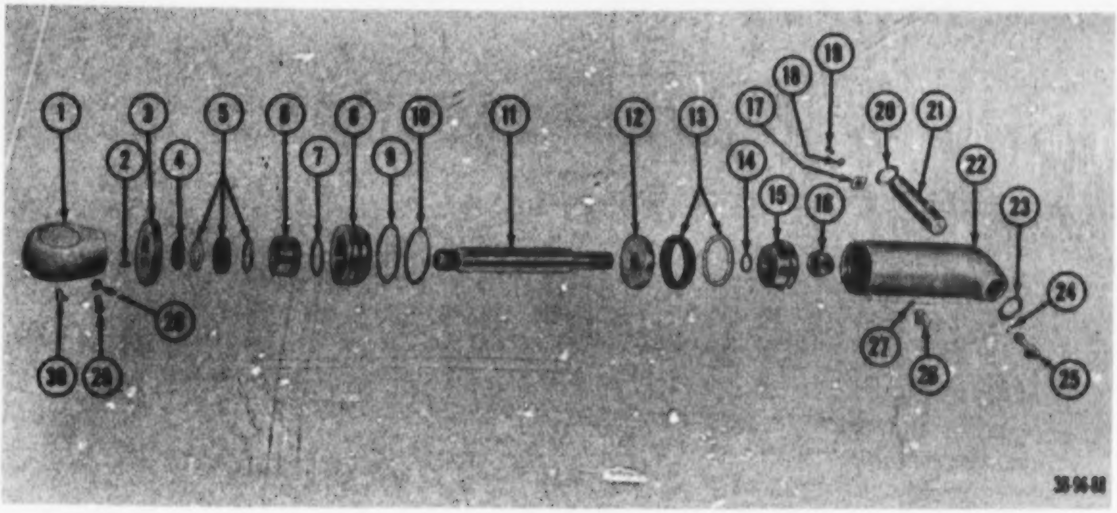
Figure 99—Continued.



1	End, rod
2	Setscrew
3	Washer, threaded
4	Ring, wiper
5	Packing
6	Retainer
7	Packing, preformed
8	Bushing
9	Ring, backup
10	Packing, preformed
11	Rod
12	Piston half
13	Packing assembly
14	Packing, preformed
15	Piston half
16	Nut
17	Keeper
18	Lockwasher
19	Screw
20	Washer, special
21	Pin
22	Shell
23	Washer, special
24	Packing, preformed
25	Elbow
26	Elbow
27	Packing, preformed
28	Nut, plain
29	Setscrew
30	Fitting, lubrication

Figure 100. Tilt cylinder, exploded view.

(4) Slide plunger (12) from housing (6).

(5) Remove packing gland (18) and spacer (20) from plunger.

(6) Remove upper bushing (16), seal (19), and packing (17) from packing gland.

(7) Remove lower bushing (21) from spacer (20).

(8) Remove retaining ring (8) from bottom of plunger.

(9) Remove lower piston half (9), packing (10) and packing (11) from plunger.

(10) Remove fitting (22) from housing.

(11) Remove spacer (24), spring (25), and special washer (20) from housing.

(12) Remove packing (23) from fitting (22).

c. Cleaning, Inspection, and Repair.

(1) Wash all parts in SD.

(2) Make certain that the adapter (22), spacer (24), spring (25), and special washer (26) which make up the lowering control valve are thoroughly clean.

(3) Inspect for scored cylinder walls.

(4) Check housing for cracks and breaks.

(5) Inspect piston and plunger for nicks and burs.

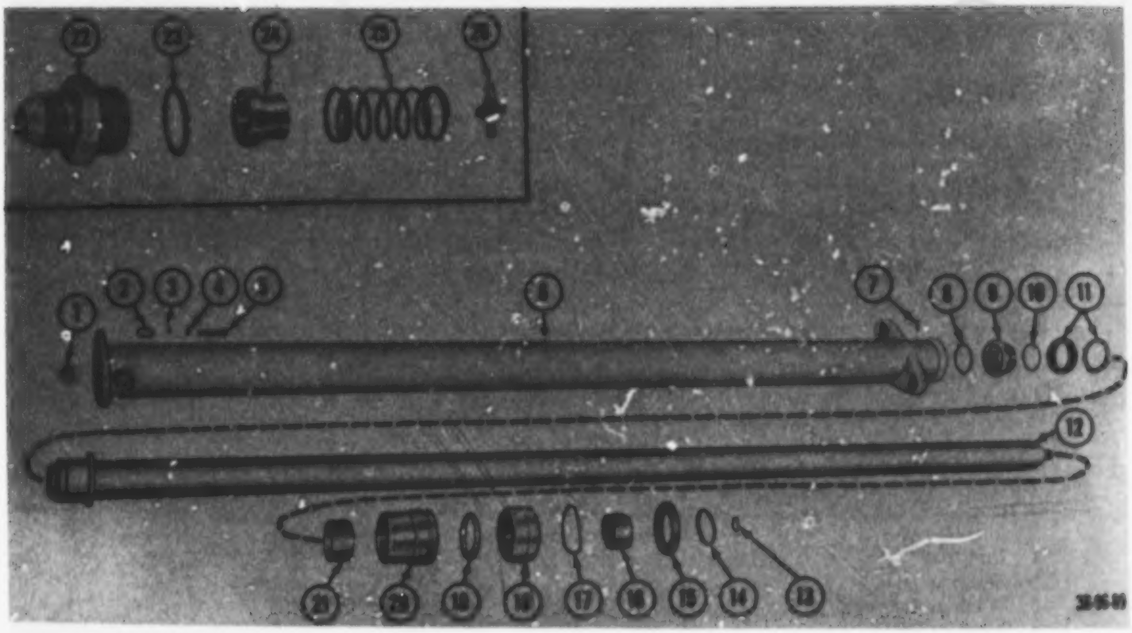
(6) Replace all defective parts as authorized.

d. Assembly.

(1) Lubricate all parts with hydraulic fluid.

(2) Reverse procedures in *b* above.

e. Installation. Reverse procedures in *a* above.



1	Pin, fulcrum	14	Ring, wiper, head washer
2	Spacer	15	Washer, threaded, cylinder head
3	Washer	16	Bushing, rod guide, upper
4	Lockwasher	17	Packing, preformed
5	Screw	18	Gland, packing, piston rod
6	Housing	19	Seal
7	Screw	20	Spacer
8	Ring, retaining	21	Bushing, rod guide, lower
9	Piston half	22	Adapter, pipe-to-tube
10	Packing, preformed	23	Packing, preformed
11	Packing	24	Spacer
12	Plungers (piston rod)	25	Spring
13	Ring, retaining	26	Washer, special

Figure 101. Hoist cylinder, exploded view.

68. Fork Carriage

a. Removal.

(1) Remove forks. (Refer to TM 10-3930-222-20.)

(2) Raise inner upright until space permits removal of carriage from upright assembly.

(3) Block inner upright securely.

(4) Remove chains from carriage (par. 70).

(5) With suitable lifting device, remove carriage from upright assembly.

b. Disassembly.

(1) Remove load fork lead screws (par. 69).

(2) Remove retaining ring (9, fig. 102) and remove shim (8), load roller (7), and shim (6).

(3) Remove remaining rollers.

c. Inspection.

(1) Inspect rollers for wear and out-of-round.

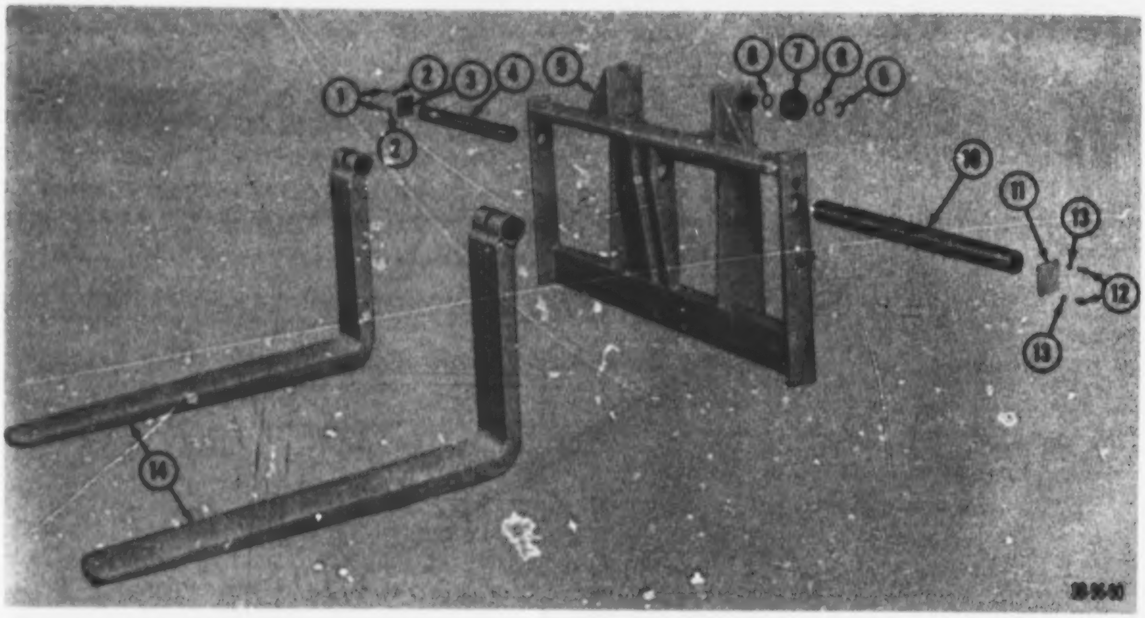
(2) Inspect crank assembly for wear.

d. Assembly.

(1) Reverse procedures in *b* above.

(2) Reverse rollers if worn.

e. Installation. Reverse procedures in *a* above.



1	Capscrews
2	Lockwasher
3	Plate, keeper
4	Pin, load fork
5	Frame, carriage
6	Shim
7	Roller, load
8	Shim
9	Ring, retaining
10	Pin, load fork
11	Plate, keeper
12	Capscrews
13	Lockwasher
14	Forks, load

Figure 102. Fork carriage, exploded view.

69. Crank Assembly and Lead Screws

Refer to figures 102 and 103 and remove crank assembly and lead screws as follows:

a. Removal.

(1) Remove load fork (TM 10-3930-222-20).

(2) Turn crank handle until left-hand and rigth-hand nuts (2 and 9, fig. 103) are positioned about three inches from left and right edge of carriage.

(3) Remove spring pin (5) from collar (6) that connects the lead screws (3 and 8).

(4) Remove spring pin (11) that connects handle to screw (8) and remove handle.

(5) Hammer on crank end of screw (8) with proper tool to remove bushing (1) from opposite end of carriage.

(6) Hammer on other end of screw (3) with proper tool to remove bushing (10) from opposite end of carriage.

(7) Turn screws through center of carriage, either to right or to the left, until nuts (2 and 9) can be removed from screws.

(8) Remove screws from carriage. Drive bushings (4 and 7) from carriage.

b. Installation. Reverse procedures in *a* above.

70. Cable Chain

a. Removal.

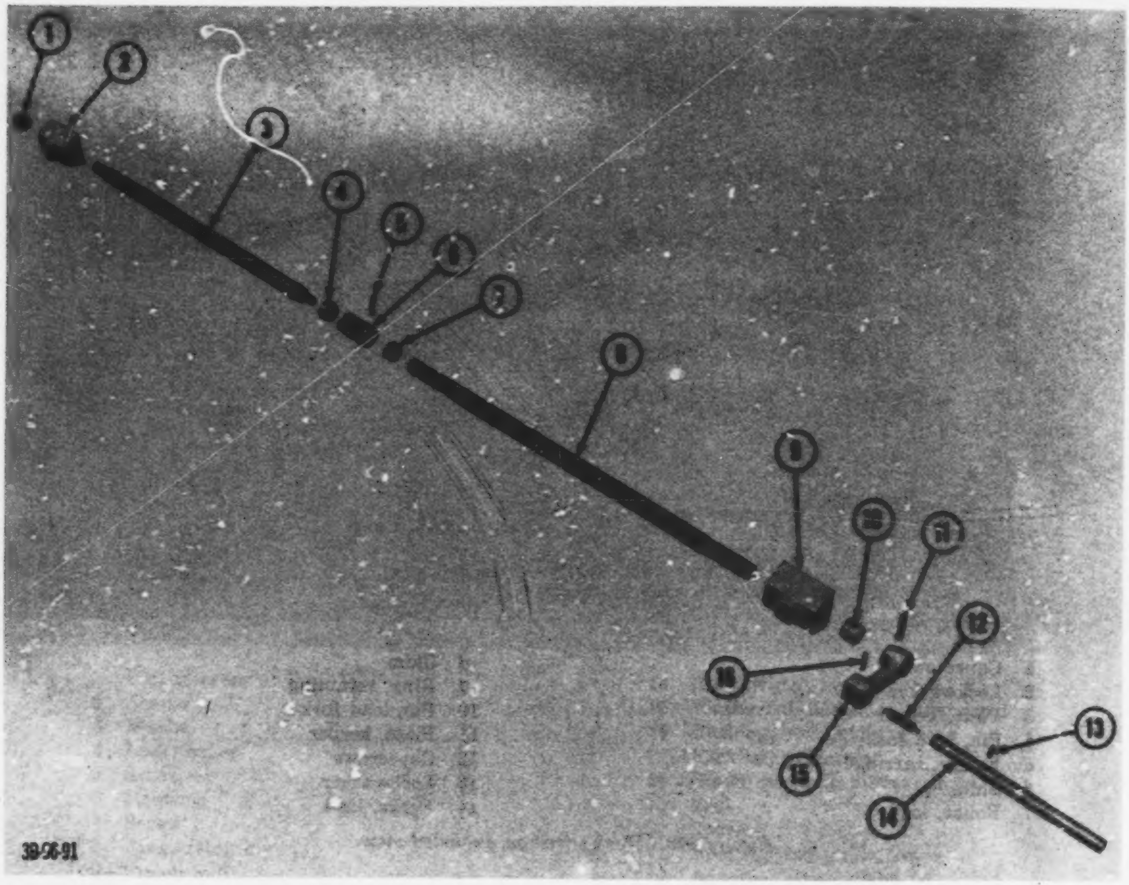
(1) Unscrew stop nuts (2, fig. 104) that secure chains (1) to lift carriage.

(2) Unscrew stop nuts that secure chains to hoist cylinder and remove washers (5) and chains from hoist cylinder brackets.

(3) Remove cotter pin from straight pin (3) and remove pin from anchor (4).

(4) Remove chain from anchor.

(5) Remove chain from rollers on mast.



1 Bushing
2 Nut, right-hnad lead screw
3 Screw, lead, right-hand fork adjusting
4 Bushing
5 Pin, spring
6 Collar, thrust
7 Bushing
8 Screw, lead, left-hand fork adjusting
9 Nut, left-hand lead screw
10 Bushing
11 Pin, spring
12 Spring
13 Capscrew
14 Handle, crank
15 Lever, crank
16 Pin, spring

Figure 103. Crank assembly and lead screws, exploded view.

(6) Remove anchor from other end of chain if necessary.

(7) Repeat procedures above to remove other chain.

b. Repair. Replace defective and worn links.

c. Installation. Reverse procedures in *a* above.

71. Upright Assembly

a. Removal.

(1) Remove forks (TM 10-3930-222-20).

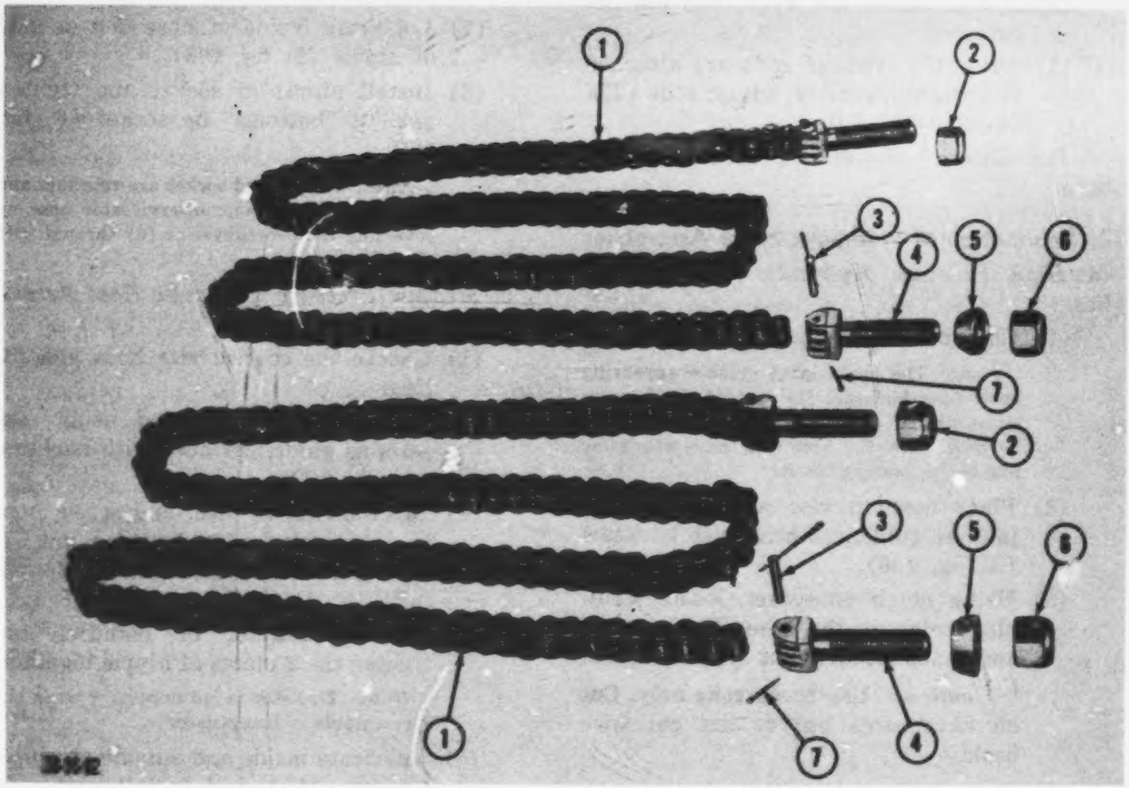
(2) Tilt upright assembly to the back position.

(3) Disconnect hydraulic lines at hydraulic hoist cylinder.

(4) Disconnect vent line at bottom of hydraulic hoist cylinder.

(5) Disconnect tilt cylinder rods on each side of upright assembly.

(6) Remove screws that secure cap bearings to outer upright and frame and remove cap bearings.



1 Chain, cable
2 Nut, stop
3 Pin, with cotter pins
4 Anchor, chain
5 Washer, spherical
6 Nut, stop
7 Pin, cotter

Figure 104. Cable chain.

(7) Using suitable hoist, remove upright assembly from truck.

b. Disassembly.

(1) Remove chains (par. 70).
(2) Remove carriage (par. 68).
(3) Remove hoist cylinder (par. 67).
(4) Separate inner and outer uprights.
(5) Remove retaining ring (3, fig. 105), shims (1), and load roller (2) from upright.
(6) Remove capscrew (4), lockwasher (5), and keeper (6) from upright frame.
(7) Slide pin (7) from upright and remove sheave (11) and washers (8).
(8) Remove bearings (9) and retaining rings (10) from sheave.
(9) Repeat procedure in (5) through (8) above to remove other roller and sheave.
(10) Remove snap ring (17) and upright roller (16) from inner upright.
(11) Remove shim (13), snap ring (14) and bearing (15) from inner upright.

c. Inspection.

(1) Clean all parts except bearing in SD.
(2) Inspect rollers for wear and out of round.
(3) Inspect bearings for wear.

d. Assembly and Adjustment.

(1) Reverse procedures in *b* above.

(2) If load rollers are worn, they may be reversed.

(3) After tilt cylinder rods are attached to upright assembly, adjust rods (TM 10-3930-222-20).

e. Installation. Reverse procedures in *a* above.

72. Fabrication of Hydraulic Hose Assemblies

a. High Pressure Hydraulic Hose Assemblies.

(1) Choose correct size hose and fitting.

Note. The hyphenated number appearing on a hose indicates the size of the hose in sixteenths of an inch, and correct fitting to be used with the hose will have the same number appearing on it.

(2) Place hose in vise and, using vise jaws as guide, cut hose with hacksaw (A, fig. 106).

(3) Using notch on socket, locate stripping point on the hose (B, fig. 106) and make circular cut with hacksaw.

Caution: **Use backstroke only. Cut all fibre cords but do not cut wire braid.**

(4) Using backstroke with hacksaw, make a diagonal cut (C, fig. 106).

(5) Use a screwdriver to pry the cover loose and use pliers to twist cover off (C, fig. 106).

(6) Place socket in vise, and screw hose in counterclockwise direction until it "bottoms," then back off one-fourth turn (D, fig. 106).

(7) Lubricate inside of hose and outside of nipple (E, fig. 106).

(8) Install nipple in socket and tighten until it "bottoms" on socket (F, fig. 106).

Note. Nipple and socket are reusable and can be removed from unserviceable hose by reversing the procedures in (6) through (8) above.

b. Medium Pressure Hydraulic Hose Assemblies.

(1) Choose the correct size hose and fitting.

(2) Place hose in vise, and using vise jaws as guide, cut hose with hacksaw (A, fig. 107).

(3) Place socket in vise, and screw hose in counterclockwise direction until it bottoms; then back hose off one-fourth turn (B, fig. 107).

(4) Use an adapter or mandrel and tighten the 2 pieces of nipple together.

Note. This step is not necessary when one piece nipple is being used.

(5) Lubricate inside and outside of nipple (A, fig. 108) and install nipple in hose (B, fig. 108). Tighten until the hex bottoms.

Note. When using two 2-piece nipples back off one-fourth turn after tightening. Nipple and socket are reusable and can be removed from unserviceable hose by reversing procedures in (3) through (5) above.

1	Shim
2	Roller, load
3	Ring, retaining
4	Capscrew
5	Lockwasher
6	Keeper
7	Pin
8	Washers, flat
9	Bearing
10	Ring, retaining
11	Sheave
12	Member assembly, outer
13	Shim
14	Ring, snap
15	Bearing, ball, load roller
16	Roller, load
17	Ring, snap

Figure 105. Upright assembly, partially exploded.

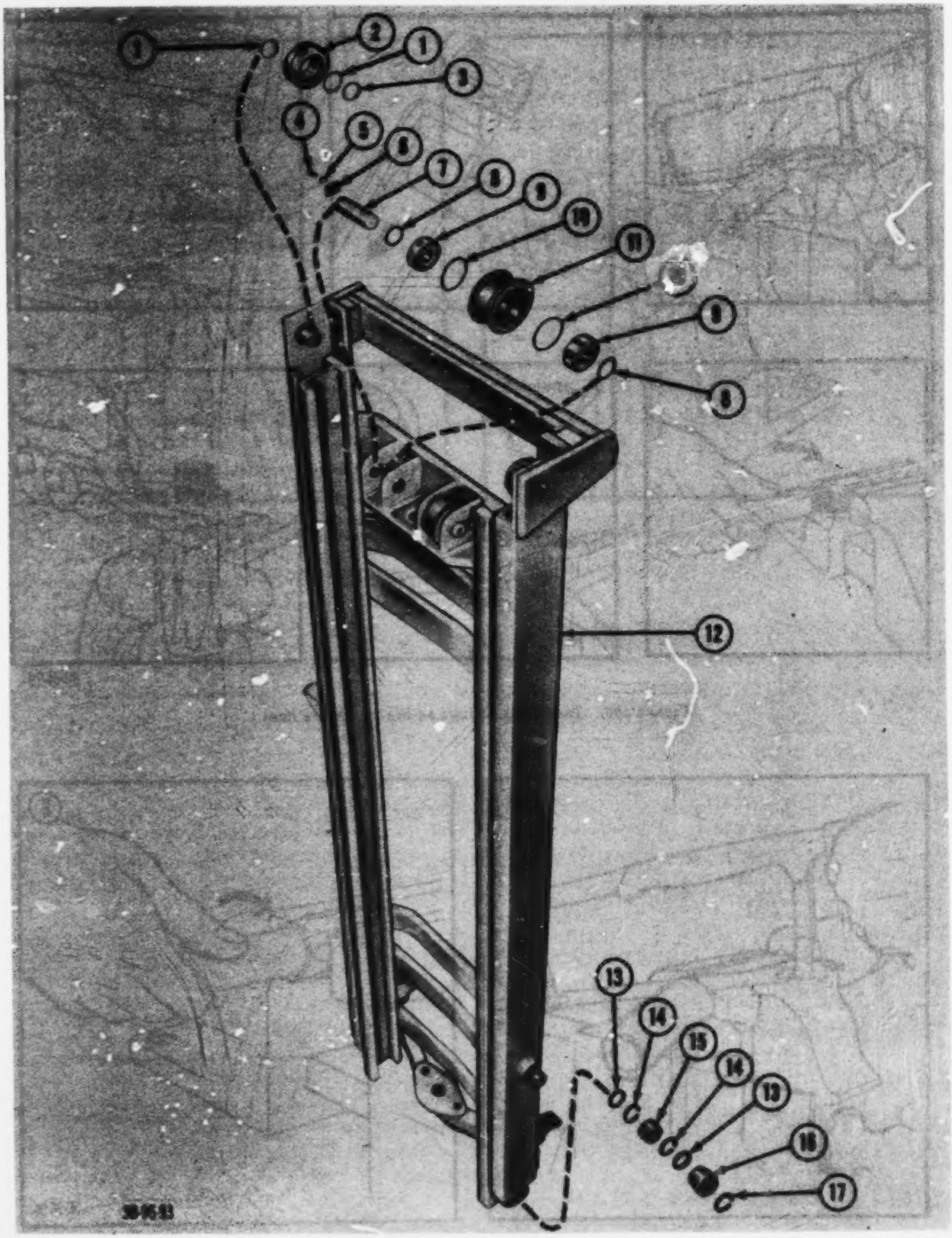

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Figure 105—Continued.

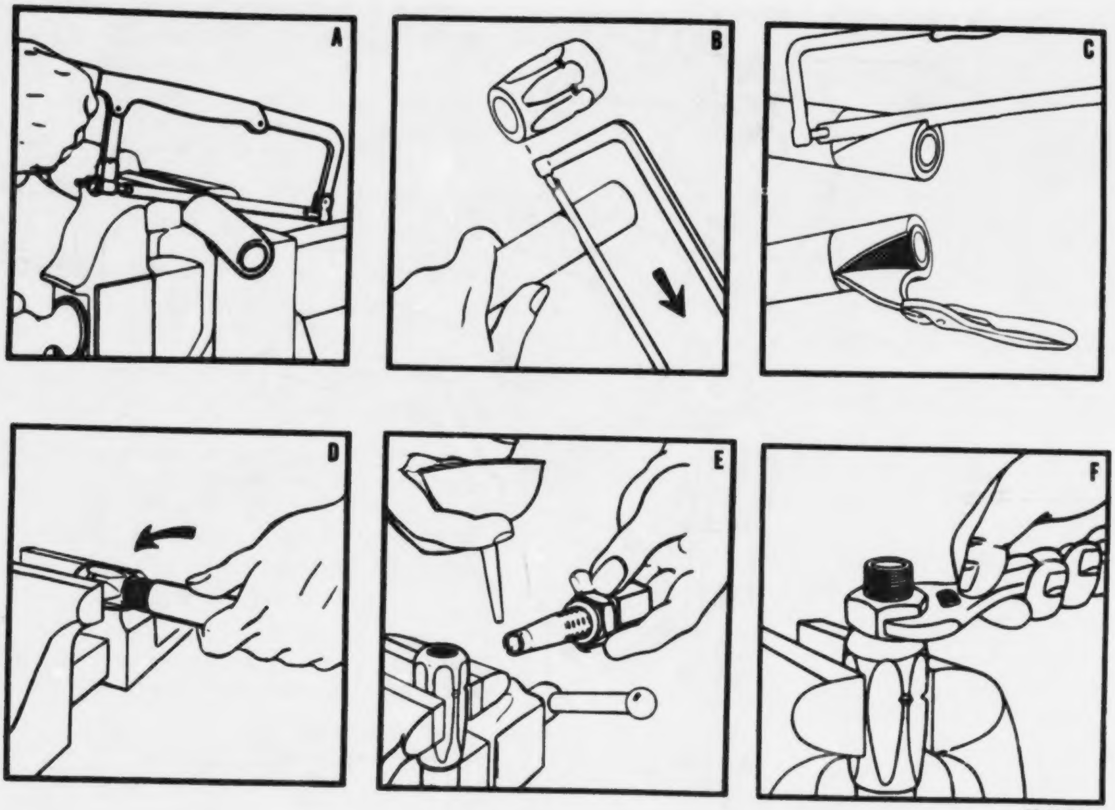

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Figure 106. Installing fittings on high pressure hose.

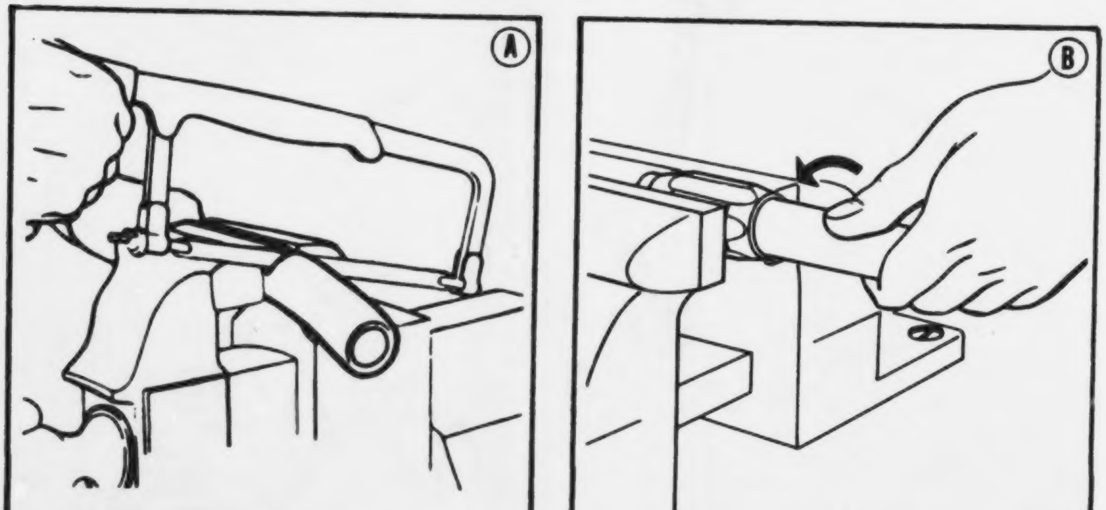

Figure 107. Cutting and installing medium pressure hose.

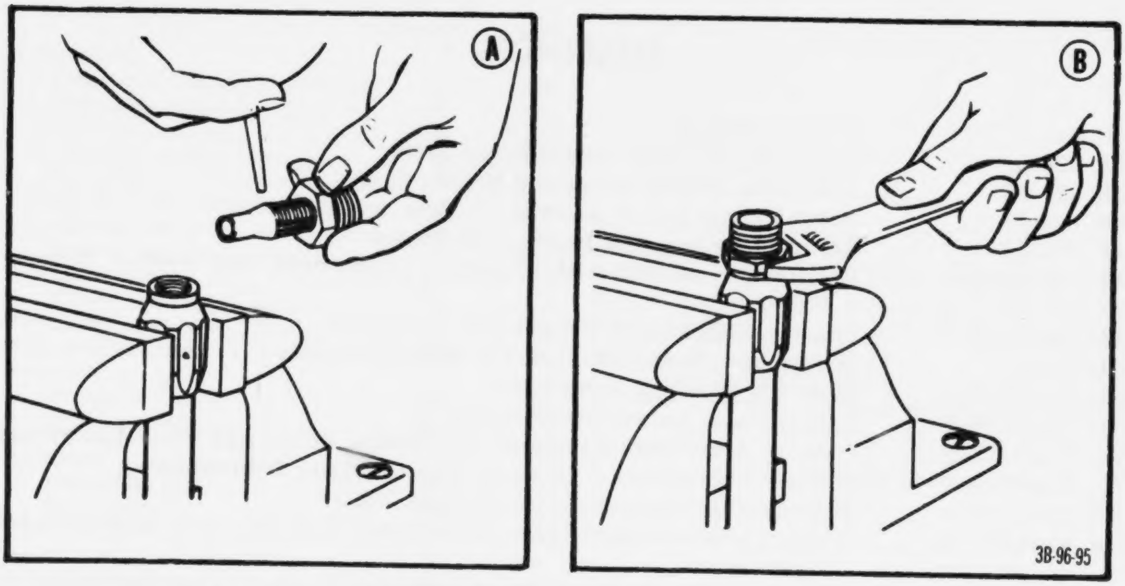

Figure 108. Lubricating and tightening fitting on medium pressure hose.

APPENDIX

REFERENCES

AR 310-1	General Policies
AR 320-5	Dictionary of United States Army Terms
AR 320-50	Authorized Abbreviations and Brevity Codes
AR 600-55	Motor Vehicle Driver Selection, Testing, and Licensing
AR 700-58	Report of Damaged or Improper Shipment
AR 700-3900-5	Registration of Materials Handling Equipment and Special Purpose Vehicles.
AR 746-2300-1	Color and Marking of Vehicles and Equipment
AR 750-5	Maintenance Responsibilities and Shop Operations
AR 750-3900-1	Materials Handling Equipment
AR 754-9130-1	Utilization of Automotive Gasoline
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings
DA Pam 310-1	Military Publications: Index of Administrative Publications
DA Pam 310-2	Military Publications: Index of Blank Forms
DA Pam 310-3	Military Publications: Index of Doctrinal, Training, and Organizational Publications.
DA Pam 310-4	Military Publications: Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction
FM 21-30	Military Symbols
TM 10-450	Sheet Metal Work, Body, Fender, and Radiator Repairs.
TM 10-3930-222-10	Operator's Manual; Truck, Lift, Fork, Gasoline, Pneumatic-Tired Wheels, 15,000-Pound Capacity, (Hyster Model H150C, Army Model MHE 178), Federal Stock Number 3930-897-4632.
TM 10-3930-222-20	Organizational Maintenance Manual; Truck, Lift, Fork, Gasoline, Pneumatic-Tired Wheels, 15,000 Pound Capacity (Hyster Model H150C, Army Model MHE 178) Federal Stock Number 3930-897-4632.
TM 10-3930-222-20P	Organizational Maintenance Repair Parts and Special Tool Lists; Truck, Lift, Fork, Gasoline, Pneumatic-Tired Wheels, 15,000-Pound Capacity, (Hyster Model H150C, Army Model MHE 178), Federal Stock Number 3930-897-4632.
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TM 21-300	Driver Selection and Training (Wheeled Vehicles)
TM 38-230	Preservation, Packaging, and Packing of Military Supplies and Equipment
TM 38-750	The Army Equipment Record System and Procedures
SM 3-C68P-ML, Vol 2, 1 Jul 62.	List of Standard Reference Fuels, Solvents, and Preservative Material for Which QMC is Assigned Logistics Responsibility.
MIL-STD-162A	Preparation for Delivery of Warehouse Materials Handling Equipment for Domestic and Oversea Shipment and Storage.
LO 10-3930-222-20	Lubrication Order; Truck, Lift, Fork, Gasoline, Pneumatic-Tired Wheels, 15,000-Pound Capacity (Hyster Model H150C, Army Model MHE 178), Federal Stock Number 3930-897-4632.

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NG: None.

USAR: Units—same as Active Army.

For explanation of abbreviations used, see AR 320–50.

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